## Armor Material in Europe.*

### Official Report to the U. S. War Department.

BY WM. H. BIXBY, CAPT. OF ENGINEERS U.S.A.

(*Concluded from Page 35*).

In the *construction of Gruson chilled-iron casemate-batteries*, the embrasure plates require abutments against which they can rest for support; these abutments are turned "posts," "pillars" or "merlons." At first these merlons were made in the shape of a hollow vertical V-shaped cylinder, the point of the V being turned toward the front, and the wide hollow portion of the V being on the interior of the battery. Afterward the shape was modified, by making the interior of the V solid to some distance back from the point; then the rest of the two arms of the V was replaced by a single T-shaped arm projecting toward the rear from the center of the solid V in its front. This latter form has the advantage of greater solidity; at the same time, it allows more room in the interior of the casemate for the manœuvre of the gun, and for the service of the cannoniers. The merlon plate is absolutely necessary as an abutment to the ends of the arch formed by each embrasure plate. An embrasure plate set up alone and fired at would resist but for a short time; once cracked, it would fall backward and inward. With two merlon plates as abutments, the embrasure plate can be cracked into several pieces and yet remain in shape and capable of further resistance; the various pieces into which the embrasure plate may be cracked, from voussoirs supported by each other and by the merlon plates, in the same manner that the stones in an ordinary arch are supported by each other and by their abutments. In some of the test-trials of these embrasure plates, such pieces have sometimes been forced out of place as much as 2 centimetres toward the front by one shot, and then knocked back into place again by a succeeding shot.

Mr. Gruson would prefer to use even a greater thickness of plate than he does at present; motives of economy have caused his customers to ask for the minimum thickness.

The Italians limit the weight of each finished plate, for mountain forts, to about 15 tons, on account of the difficulty of transporting heavier weights over their railroads into their mountain districts. The manufacturer, however, is at present in favor of making as large castings as possible. Embrasure plates were formerly made so that the whole embrasure was contained within the limits of a single plate. During the experimental trials of 1873 and 1874, it was found that those plates broke up first along the vertical plane through the center of the embrasure, and afterwards along a nearly horizontal surface through the embrasure; the direction of these planes of fracture being apparently due to unequal contraction in the metal of the plate during cooling, as influenced by the existence of the embrasure hole. In late constructions the embrasure plate is divided into two parts, along a vertical plane passing through the center of the embrasure; this method of construction prevents a crack from extending through the embrasure from one side of the plate to the other. If the size of cupolas and thickness of the metal should be still further increased, it is possible that another joint might be introduced at right angles to the first, so as to divide the embrasure plate into four pieces instead of two as at present.

In some of the preceding trials of chilled iron plates, shot have been fired so as to strike very close to the edge of the embrasure without too badly breaking the chilled iron. The manufacturer feels confident, that if a shot should strike between the chase of the gun and the side of the embrasure, it would be the gun rather than the side of the embrasure that would receive more serious damage.

Cupolas for 12-c.m. guns can best be made in a single piece of metal; the only objection to the use of a single plate being the difficulty of transporting it. Larger cupolas have to be made of several plates, usually six side plates and a single or divided cover plate.

The process of making the *Gruson* chilled-iron armor-plates is about as follows:—Knowing the size of the gun, and the angles of elevation and depression at which it is desired to fire the gun, the manufacturer determines the interior size of the cupola or casemate, and that of its embrasure; he then builds an imitation fort of iron frames with brick fillings and plaster outside. A wooden gun, of the actual size of the real gun, is then made and placed with its muzzle in the embrasure; this wooden gun is next moved around through all its desired positions of elevation and traverse, and the embrasure is built up or cut away until it will allow of all desired movements of the gun, while leaving also in every case a margin of 2 inches between the chase of the gun in its extreme positions, and the side of the embrasure. A wooden model is next constructed to fit accurately the outside of the brick-and-plaster fort; this wooden model is divided into sections, each corresponding to one of the blocks into which the whole cupola will be finally divided; each section is made about once and a half as thick as the fort itself, and serves as a mould for casting an iron chill. Iron chills are then cast, one for each differently shaped plate of the finished fort; they are made of ordinary cast-iron, and may weigh anywhere between 50 and 100 tons apiece; at least 4 differently shaped chills are needed for every new battery, and at least 3 for every turret. After the chills have been cast, a second wooden model is made to fit the *interior* of the brick-and-plaster fort; this second wooden model, taken in connection with the iron chill just mentioned, is used for the construction of a third set of wooden models, exactly representing each armor-plate of the finished fort. The iron chills, and the wooden models suitably stiffened by iron ribs and filling, are then used in forming the moulds for casting the chilled-iron armor-plates, the chill being placed at the bottom of the pit, with its hollow side turned upward. The hollow side of the chill must be hammered smooth before actual use, in order to give good results. The *armor plate* itself is next cast, its outer surface being chilled by contact with the cold iron of the chill beneath it. After the armor plate has cooled off sufficiently to enable it to be worked, its bearing surfaces are planed by machinery until they give accurate surfaces of contact with the sub-structure, with the plates on each side, and with the cover plate on top.

Two or more cupola-furnaces are used in the *process of casting* the chilled iron plate, and the cast-iron is run from each into a large cauldron. These cauldrons are connected by troughs at their bottom, so that all the metal can be run from the cauldrons into the trough, and there be thoroughly mixed when desired. The melted iron is allowed to cool until its temperature has been lowered to the required degree, which is slightly above the point at which the iron begins to solidify. At the end of the trough nearest to the outlet gate, a certain quantity of some other metal is added o serve a purpose somewhat similar to that of Spiegeleisen as used in the Bessemer steel process. In order to allow this added metal to be thoroughly mixed with the cast-iron, it is made into the form of small plates, and then fastened to the end of wrought-iron rods with which the cast-iron is stirred; these plates melt slowly off from their wrought-iron handles during the stirring process, and thus become thoroughly dispersed through the fluid cast-iron. Finally when the whole metal has reached the proper temperature, the outlet gate is opened; and the whole fifty or more tons run into the mould, disappearing from sight in less than a minute.[1]

Each chill can be used over again about ten times As each casemate consists of pieces of at least four or five different shapes, it is much cheaper *per gun* to make an 8 or 10-gun casemate, or two 4 or 5-gun casemates, than to make a casemate for a less number of guns.

The Gruson turrets will *cost*, mounted in place, including all expenses, except transport in vessels, about $200 a ton. Their cost, delivered at the foundry, is about $150 per ton. These prices are of course only approximate, and must vary greatly from time to time.

As regards the payment for cupolas, the manufacturer generally demands one half of the total price, payable in cash upon the giving of the order; one quarter on completion of the cupola and its erection in position; and the other quarter after two years, during which time he will repair any accidents due to his errors or defects in his construction of the cupola.

A Gruson 5-gun casemated battery, for 24-c. m. guns will cost, approximately, $66,000 per gun, for the Gruson chilled-iron casemates; and $33,000 per gun for the Krupp cannon. A two-gun cupola for 24-c. m. guns, would cost, approximately, $74,000 per gun for the Gruson chilled-iron cupola, and $33,000 per gun for the Krupp cannon. These prices do not include the cost of building the foundations; nor do they include the service of, say, twenty men for about three months during the mounting of the iron work in place.

Chilled iron forts, once constructed, can be exactly duplicated at an expense much less than $150 per ton; if duplicated at once, the reduction in price may amount to as much as 30 to 40 per cent. The reasons for such great reduction are at once evident to any iron founder.

Whenever the construction of chilled iron forts is to be done by Mr. Gruson, at Magdeburg, Mr. Gruson must have full control of the manufacture; it would not be possible for him to allow any foreign government to enter his works and dictate to him as to the rapidity of work or movements of his workmen. He must be furnished with full plans of the projected fort, upon which he will make estimates of the actual cost and final price for the finished cupola.

The method generally followed by foreign countries in ordering chilled iron forts from Mr. Gruson is as follows:

When they have decided to adopt chilled iron, and feel pretty certain that they will order the work from the Gruson factory, they draw up general plans of the fort as they want it, omitting all strategical and topographical details and all other parts of the fort not directly dependent upon the iron work and immediate service of the gun. These general plans are sent to the manufacturer, who looks them over, suggests all modifications that seem to him necessary, and returns them. From these plans as corrected, the definite plans are drawn up and reforwarded to the manufacturer, who constructs his brick and mortar model from these latter plans and drawings.

The Gruson works should be furnished,

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[1] The writer was present at the casting of two such plates.

from the first, with drawings of the gun to be used; and be informed as to its service charge, its recoil, and its desired elevation and depression; so that the interior dimensions of the cupola can be exactly calculated, and the sole, roof, and cheeks of the embrasure can be properly modelled.

So far (1881-2), all Gruson forts have been arranged for the Krupp breech-loading guns and the Gruson minimum-embrasure muzzle-pivoting carriage. The combination of the Gruson carriage with any breech-loading gun is very favorable to rapidity of fire.

The Gruson works have in their service, men who have been educated as civil engineers, and also as engineer and artillery officers. All little details as to machinery, and as to its best disposition as regards the engineer and artillery service of the casemates and turrets, can be safely left to them.

In order to properly assure themselves as to the quality of the work furnished by Gruson's factory, it is customary for foreign governments to send a competent officer to Magdeburg to be present during the actual manufacture of the armor plate and tests of the gun carriages.

Whenever foreign manufacturers or governments desire to manufacture the chilled-cast-iron themselves, Mr. Gruson sells the right and teaches the process of manufacture at a royalty of (roughly speaking) about $10 per ton on all the chilled-cast-iron they might make during a certain number (probably 15) of years, commencing with the year when they begin actual work; to this must be added a minimum royalty payable during, or at the end of, the fifteen years, so as to secure Mr. Gruson in case of no actual work on the part of the contractors.

This royalty must be a certain number of dollars per ton weight of the manufactured article and not per value of this article; the cost of labor, and the cost of metal, might vary from time to time, but the weight of the metal never changes; consequently the weight would furnish a certain basis upon which the royalty could be properly based.

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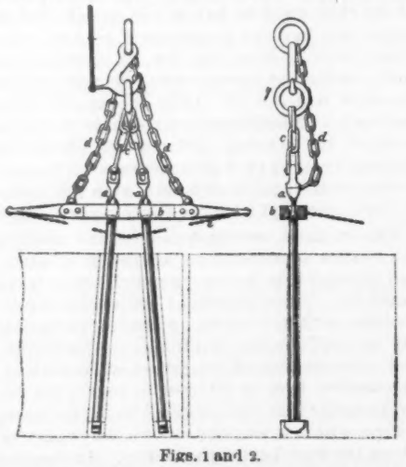
*——Author unknown.


## A New Stone-Lewis.

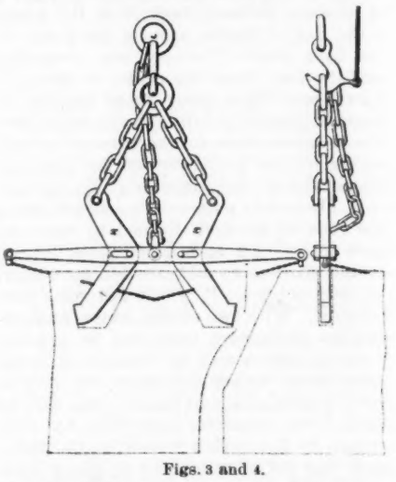
Mr. Darnton-Hutton, engineer of the canal from Amsterdam to the North Sea, had devised an ingenious appliance for laying the large stone blocks used in the locks. This apparatus is composed of two iron rods provided at the bottom with a T-head, and twisted at the upper end into the form of a screw (see Figs. 1 and 2). These bars are introduced into drill-holes of elliptical section practically, extending through the block and with a socket for the T-head cut at the bottom of the holes, so that when this head is turned the stone is supported on the wings when being lowered to its place.



Figs. 1 and 2.

To disengage the apparatus, all that is required is to pull the chain *d* attached to the end of the horizontal bar of iron *b* so as to raise this latter. This movement causes the rod *a* to make a quarter-turn, and it can then be withdrawn through the elliptical hole in the block. The small chain *e*, to which a rope is attached, serves to pull the stone to the right or left as it is being placed.

Figs. 3 and 4 show a variation in the same design in which the two vertical bars are replaced by two nippers *x x*, which act mainly by pressure against the sides of the block in appropriate cavities cut in the stone.



Figs. 3 and 4.

## Inclination of Conduits.

The actual rate of fall adopted by engineers may be studied in the following series of examples. The celebrated Shaw's Water aqueduct or canal, which conveys water to Greenock for mill-power and supply of the town, has a fall of 4 feet per mile throughout its length of five miles. The canal from the River Durance to Marseilles, intended for irrigation and water-power, has a fall of 2.416 feet per mile. The Ganges canal, the largest in the world, having a course of 898 miles, navigable throughout, and furnishing irrigation to 5,400,000 acres, has a fall of 15 feet per mile, a depth of 10 feet, and a constant bottom width of 140 feet. The fall in this canal may, from its vast dimensions of traverse section, be considered very great, and the resulting velocity such as would ordinarily wear down the sides; in tropical countries, however, it would appear that the growth of aquatic plants, causing a great increase of resistance on the bottom and sides, is a serious evil to canal works, and necessitates a greater inclination of surface than would be required in higher latitudes. The Croton Waterworks, supplying the city of New York, afford the finest modern example of water supply, having the great advantage of a covered channel, so essential to the purity and low temperature of water. The fall is 13½ inches or 1.125 feet per mile. The supply from Loch Katrine for the city of Glasgow is by a culvert or tunnel 8 feet in diameter; in crossing the intervening valleys a cast-iron pipe, 4 feet in diameter, is used like an inverted syphon, the total fall from point of entry to that of delivery being at the rate of 5.28 feet per mile. The canal de l'Ourcq, conveying water to Paris, has a fall of 0·5575 feet per mile. The new River is graduated to 0.25 feet per mile, which is too small, as in summer the water becomes raised in temperature from the great surface exposed in its long course, and from the low rate of motion, which is about half a mile per hour.

## Municipal Engineering; Paper No. 1.*

### BOSTON, MASSACHUSETTS.

(Continued from page 39).

#### Management of Public Works.

Under this head we shall treat of what may be called the administrative heads of departments having charge of the actual construction and maintenance of public works, leaving out almost entirely the legislative branches of the municipal government and departments having charge of what may be termed the morals of the city.

All of the matter to follow is based upon the New City Charter of Boston, approved May 27, 1885, and the Revised City Ordinances, approved by the Councils in November, 1885.

The officials whose appointment, duties, etc. are considered pertinent to the subject matter of this series of articles will be included under the following heads, the salaries given being those provided under the new charter and ordinances as above:—

| | | | |
|---|---|---|---|
| The Mayor, | Salary, $10,000 per annum. | | |
| City Engineer, | " 6,000 " | | |
| The Water Board, | " (see Water Board). | | |
| Water Registrar, | " 3,000 per annum, bond | | $5,000. |
| City Architect, | " 3,500 " | | |
| City Surveyor, | " 3 300 " | | |
| Street Comms. | " 3,900 " | each | |
| Supt. of Streets, | " 4,000 " | bond, | 5,000. |
| " " Sewers, | " 3,500 " | " | 2,000. |
| " " Buildings, | " 3,600 " | " | 5,000. |
| " " Lamps, | " 3,500 " | " | 5,000. |
| Members of the Board of Health, | " 3,000 " | each | |
| Supt. of Health, | " 3,500 " | " | 10,000. |
| Inspector of Buildings, | " 2,800 " | | |

#### The Mayor and his Executives.

The Mayor of the City of Boston, who is himself elected annually in the month of December by popular vote, shall under the new charter "appoint, subject to confirmation by the Board of Aldermen, all officers and boards now elected by the City Council, or Board of Aldermen, or appointed by him subject to confirmation, and all such whose offices may hereafter be established by the City Council, or Board of Aldermen, for such terms of service respectively as are or may be fixed by law or ordinances; and he may remove any of said officers, or members of such boards, for such cause as he shall deem sufficient and shall assign in his order of removal. No appointment made by the mayor shall be acted upon by the Board of Aldermen until the expiration of one week after such appointment is transmitted to the Board."

The same new charter provides that no member of the City Council can be appointed to any of the offices included under its provisions during the term for which he is elected, and any official actually appointed and confirmed shall, unless sooner removed, hold office until his successor is appointed and duly qualified. The officers and boards so appointed, can appoint their respective subordinates and remove them for cause assigned.

The mayor is vested with all the executive powers of the city and all the executive powers formerly vested in the Board of Aldermen, as surveyors of highways, county commissioners, etc., and he is to exercise these powers through the several departments and boards under his general supervision and charge. Each officer and board can, in their respective departments, make all necessary contracts for labor and material needed for the construction, alteration or repair of all public works, etc., and have the direction and control of all the executive and administrative business of the city. But they are at all times accountable for the proper discharge of their duties to the mayor as chief executive officer, "whose duty it shall be to secure the honest, efficient and economical conduct of the entire executive and administrative business of the city, and the harmonious and concerted action of the different departments." In the making of the contracts above mentioned, any amount involved exceeding $1,000 must have the approval of the mayor before going into effect.

The mayor must once a month, or oftener, call together the heads of departments for consultation and advice, and at these meetings all officers must furnish any information required by the mayor. Estimates for money to be expended in the next financial year must be annually furnished by each department to the mayor, and he submits them with his recommendation to the City Council.

The new City Ordinances provide generally for all the officers and boards alluded to above, that they shall hold office for one year from the first Monday in April in the year in which they are appointed, or until their successors are duly qualified.

The term of office of all subordinates in the several departments shall be deemed to continue as long as the appropriation under which they are paid is renewed, unless they are removed by their superiors according to law, or discharged as unnecessary.

The office hours fixed by ordinance for heads of departments and their assistants performing clerical or office duties are from 9 A. M. to 5 P. M., except on Sundays and legal holidays, and except that on Saturdays the city offices shall be closed at 2 P. M. The mayor may grant leave of absence to all officers appointed by him, and the heads of departments can grant leave to their subordinates, subject to revocation by the mayor. All salaried subordinates and officers are entitled to a vacation of a fortnight's duration, without loss of pay, during a year of employment.

No salary can be paid by the city to a non-resident, under the City Ordinances, unless his duties are mainly outside of the city limits.

A horse and vehicle are allowed at the city's expense to the following officials:—Mayor, city engineer, inspector of buildings, superintendent of streets and the superintendent of public buildings.

Notwithstanding the fact that this new charter has effected most important changes in the executive or administrative functions of the City Government, as above outlined, and has vested all of the executive power in the mayor instead of in the Board of Aldermen, as under the charter of 1854, very considerable and important powers and duties yet remain in the hands of the Council and Board of Aldermen.

The City Councils yet establish and define by ordinance the departments necessary for the transaction of public business; establish the number of subordinates, assign their duties and provide for their compensation. The right to assess the annual taxation and apportion appropriations is untouched. They decide upon the necessity of all public works and the maintenance of public departments, and they will probably, in the future specify with much more detail, in their orders of appropriation, the different items and the purposes for which they are designated. The execution of their orders, however, will at once pass from their control to the departments which the new law puts in exclusive possession of all executive functions.

The Board of Aldermen can still, as formerly, order sewers to be located and built, and assess damages and betterments therefor; issue licenses and grant locations for railroads, gas, telegraph and telephone companies, and the like. As surveyors of the highways, they are still to decide how streets are to be constructed or paved, when the work is to be done, and to establish grades and locate sidewalks. They will also locate street lamps and order them set up and maintained. But while they can order work done, its execution is no longer under the control of committees of their body.

#### Civil Service in Boston.

The Massachusetts Legislature has passed an act (approved June 3, 1884) "to improve the civil service of the Commonwealth and the cities thereof." Under this act one Civil Service Commissioner is appointed annually by the Governor in a commission of three members, whose duty it is to prepare rules, not inconsistant with existing laws or the provisions of the act, adapted to carry out its purposes in the selection of such officers of the Commonwealth and several cities as are appointed by higher authority.

This act, by its sections, prohibits the appointment or retention in such offices as come within its provisions of persons habitually addicted to the excessive use of intoxicating beverages, or the appointment of venders of such liquors. All recommendations of an applicant from any senator, representative, alderman, or councilman, except as to the residence or character of the applicant, shall not be considered. All assessments, subscriptions or contributions, directly or indirectly, for any political purpose are prohibited; though this provision does not prevent any person from being a member of a political organization or committee. But no employe can be punished by discharge or otherwise for refusing to contribute for political purposes.

Numerous other sections follow covering other phases of this oft-times enforced taxation of employes by political masters, including implied reward for purely political services.

In the classification of offices to be filled under civil service rules, the following are exempt from its provisions: Elective or judicial officers whose appointment is subject to confirmation by the Executive Council, a city council or school committee; heads of city departments; those for whom a superior officer is required to give bond; teachers of the public schools and private secretaries of the governor or mayor.

In classification by service there are two divisions, one known as "The Official Service of the Commonwealth and the several cities thereof" and the other as "The Labor Service of the City of Boston." In the first division are two subdivisions, one referring to persons performing clerical services, and the other to the regular police of the Commonwealth and each city, guards, watchmen and overseers connected with penal, reformatory and charitable institutions, members of the Boston fire department and certain other positions where physical capacity is of prime importance. The second grand division includes day laborers in the departments of Boston controlling water, streets, sewers, etc.

All applicants must be citizens of the United States and residents of Massachusetts for one year preceding their application; though this provision does not apply where special expert knowledge is required. Every application must be supported by certificates of good moral character, health and physical and mental capacity for doing the public work.

All examinations must be absolutely impartial, practical in their character, and with paramount regard to matters which will fairly test the relative capacity and fitness of the persons examined for the particular service they seek to enter; political or religious opinions or affiliations must have no influence on the appointment. Persons who

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have served in the army or navy of the United States in time of war and have been honorably discharged, shall be preferred over others of equal qualifications under the civil service rules.

The provisions for the selection of day laborers, with which this series of articles has most to do, are as follows:—Applicants for labor in the several city departments must produce satisfactory evidence of their capacity for labor and their habits as to industry and sobriety; such men will be registered in the order of their application; the record giving name, age, residence, citizenship, number of persons depending on them for support, service in army or navy in time of war, previous occupation, reference and personal description. When the service of laborers are required by any department, the officer having the appointment or selection must notify the commissioners of the number of men wanted, kind of labor and time and place of employment; the commissioners will then forward the names and residence of twice the number of men called for, making a selection by lot or otherwise. The selection by the department is then made from this list. At the end of a term of service, the persons employed may keep their places on the register by application to the commissioners and proof that their labor has been satisfactory. If the commissioners are unable to fill a requisition, they must notify the department, which latter shall then make the selection.

In case of an emergency, when the temporary services of a large number of unskilled laborers are required in any city department, the officer having the appointment shall select by lot, or other equitable way, from those who present themselves for immediate service.

(NOTE:—As to the practical working of the system as above outlined, the writer could obtain but little satisfactory testimony. It is as yet somewhat in an experimental stage, though the new city charter and revised ordinances continually refer to its provisions. There may be occasion to refer to it again.)

(TO BE CONTINUED.)

## LITERATURE.

**Report of a Commission Appointed to Consider a General System of Drainage for the Valleys of the Mystic, Blackstone and Charles Rivers, Massachusetts, U. S. A., Boston, 1885.**

This commission was appointed May 28, 1884, by the state authorities to consider a general system of drainage for the relief of the valleys of the Mystic, Blackstone and Charles rivers, and for the protection of the public water supplies of the cities and towns situated in the basins of these rivers. They were also to consider the various methods of disposal of sewage and the application of such methods to any portion of the territory mentioned. The commission was also empowered to examine and report upon the needs of any other portion of the Commonwealth as to sewage disposal, and the protection of the public water supply. Their expenditures for this purpose were originally limited to $20,000, but an additional $13,000 was granted April 14, 1885.

The commission was organized for business on July 9, 1884, and they soon after appointed as their chief engineer Mr. Eliot C. Clarke, late engineer-in-charge of the Improved Sewerage Works of Boston. Mr. Clarke has won the highest approbation of the commission by his thorough and exhaustive report, and minute and specific information furnished regarding the many points in question. Later, Joseph P. Davis, C. E., and Rudolph Hering, C. E., were called in as consulting engineers, and under date of December 12, 1885, generally endorsed the plans of relief suggested by Mr. Clarke.

Without attempting even an abstract of the 200 8vo. pages of Mr. Clarke's report, with the carefully prepared plans suggested for particular localities, we will give such general suggestions as seem best. As giving an idea of the labor performed, 83 towns in all have been examined; 56 miles of surveys run and plotted on a scale of 400 feet to an inch, together with many other plans made from existing data; 1,263 borings were made and test-pits sunk, aggregating 16,693 feet at a cost of $5,268.76, and nearly all the investigations, surveys, etc., were made in seven months. Mr. Clarke also visited England, and there personally conferred with the leading authorities on sewerage, and examined characteristic methods of disposal in 27 cities and towns.

In making his report, the Chief Engineer first defines the problem in general terms, states the investigation necessary for a discussion of the problem under consideration, and then dividing the territory into natural drainage districts he treats of the individual towns and cities within these limits.

The problem briefly stated is, how can the sewage and other filth now or hereafter produced in the districts under consideration, be disposed of without doing harm?

The investigation necessary is to first note in the several districts their extent and physical characteristics; their population; the industries carried on within their borders; the present and prospective sources of filth pollution, its kind and extent, and the evils already engendered or likely to arise in the future.

The report then proceeds no give in full detail the results of the investigation of each basin as a whole, and the existing condition of each city or town in the basin; this portion constitutes the "problem" to be solved, and in connection with it is given a vast amount of useful and necessary information.

Part II deals with the Methods of Sewage Disposal. England is quoted as the best place in which to obtain information on this subject, as in that country alone have all methods been much used; over 200 examples of methods, which aim to remove noxious elements before permitting the water to escape exist in England, while there are probably not more than 20 such in all other countries combined.

In sketching the history of experiments in England concerning sewage treatment, Mr. Clarke states that up to the middle of the present century it was the universal custom, as in other countries, to turn the crude sewage into the nearest water course; about the time stated, experiments were commenced in treatment before permitting the sewage to escape; but these trials were made under the then common belief that the manurial elements might be saved, and prove a great source of profit. Hundreds of thousands of dollars were sunk in the attempt; it was easy enough to extract solid matter in great quantity, but it was found to have no value as a manure, or if any, considerably less than the cost of obtaining it. The idea of profit in this direction being abandoned, the next scheme was to utilize the manurial elements by applying the whole of the sewage directly to the land. By chemical analysis it was known that each 100 gallons of average (English) town sewage contained about one cent's worth of manure, and it was thought that the soil would fix and retain this manure in a condition to be taken up by vegetation. Experiments proved that growing plants would assimilate sewage that reached their roots, but that the manurial elements were not stored up in the soil alone; the soil itself was not made more fertile by the sewage application. It was also discovered that none of the commercially valuable vegetables would flourish when dosed with the great quantity of water in which the manure was dissolved.

There is a practical limit to the size of a farm secured and prepared for sewage reception. And to provide one acre to each 100 inhabitants would require for a city like Boston a farm as large as the whole town of Brookline; and even this large area would have to receive an amount of water equal to two and one-half times the annual rainfall in addition to the rain itself. As a result of actual experiment, it is found that farms which could be cultivated at a fair profit without sewage, were operated at a loss when sewage was applied continuously to the land.

There has been abundant scientific counsel and experiment in connection with this subject; a constant succession of commissions appointed by the English Government, and a long list of experts who have investigated the matter for the General Board of Health, Metropolitan Board of Works, the British Association for the Advancement of Science, Society of Arts, Institution of Civil Engineers, and the Royal Agricultural Society. The conclusions arrived at by these different bodies are about as follows:

That it is imperatively necessary that sewage should be purified in some way before turning it into the water courses;

That any method of doing this must be very expensive;

That purification by land is most efficient;

That under favorable conditions the land can be cultivated, and will return something in abatement of the cost of purification.

The English law, under the Rivers Pollution Prevention Act of 1876, forbids the putting of any solid refuse matter whatever into water courses, or on the banks in such manner as to interfere with the flow of the water, and prevents the putting of sewage into the streams, unless it is first purified by the best practicable and available means, and in each case any person aggrieved may prosecute for violation of the law. The law also forbids the discharge into water courses of any polluting liquid or refuse from manufactories; in this case the sanitary authorities must prosecute for violation, instead of individuals, thus avoiding vexatious interference with the manufacturers. Mr. Clarke says, however, that this latter section of the law seems to be totally inoperative, and that the streams in manufacturing districts are very foul from liquid refuse.

*For turning crude sewage into water*, two conditions are necessary: first, there must be always enough to dilute very greatly the matter in solution, and second, there must be a constant current, to carry away and widely disperse all suspended particles. These conditions are more rare than is generally supposed; if the sewage is turned into a current of water moving at the rate of about one mile per hour, most of the solid particles will remain in suspension until they reach places where the water is comparatively still, and then settle to the bottom. If the particles settle over a wide area, or are very much scattered, their putrescible constituents will soon be oxidized and create no nuisance; but if they settle in masses, the lower ones being kept from contact with the oxygen in the water will decompose slowly and give off offensive gases. Sewage water mixes readily with clean water, and the organic matter *in solution* is thereby diluted. If the dilution is great, say twenty-fold or more, no subsequent putrefaction is noticed. But a stream may usually have ample water to dilute the sewage, and fail during occasional droughts; the current may be sufficiently rapid, but have slack water in certain portions, and eddies in others.

*Sedimentation and Coarse Filtration.*—There are two distinct elements in sewage, i. e., matter in suspension and that held in "solution." As there are many cases where, if the particles in suspension could be eliminated, the remainder in solution could be readily disposed of, attempts have been made to remove them by the use of settling tanks, or by passing the sewage through coarse filters made of brush, straw, gravel, coke, etc. Such methods have rarely, if ever, proved satisfactory. It is practicably impossible to arrest all of the solid matter in a settling tank, and in practice, enough escapes to create trouble. The same difficulty occurs in filtration; if the filters are coarse, much of the suspended matter passes through; if they are fine enough to catch all the smaller particles, they quickly become clogged and inoperative. There are always disadvantages which offset the slight benefits. The settling tank and filters are themselves likely to be offensive. The semi-fluid sludge intercepted contains about 90 per cent. of water, and this must be drained out before the matter can be handled, and is difficult to dispose of then, as the manurial value is so slight that farmers will not cart it away, even as a gift.

*Clarification by the Use of Precipitants.*—Clarification can be accomplished by adding a precipitant to the sewage before it enters the settling tanks. This mode has been adopted by about 50 cities and towns in England. The precipitants most generally employed and the least expensive, are lime and sulphate of alumina; the former is the cheaper and most generally used with results about as satisfactory as with the more expensive chemicals. To clarify ordinary town sewage, about one ton of lime is necessary for each million gallons of sewage. Ordinary quick lime, such as is used for house building, is employed; a rich, fat lime preferred. The lime is first slacked by adding an equal weight of water; it is then ground fine in a small pug-mill, a little water being added during the process. The paste is then mixed with more water until a cream of lime, like ordinary whitewash, is produced, and this is added to the sewage in a well in which are revolving paddles, called agitators, by which the lime and sewage is thoroughly incorporated. Thence the sewage flows to settling tanks. As to result, within a few minutes after the lime is added a flocculent precipitant is seen to form throughout the body of the sewage and to sink rapidly to the bottom of the tank. If the tank after being filled is left at rest for half an hour, the precipitate will all have settled and the supernatant liquid can be drawn off entirely clear, excepting a slight scum on the surface. A number of tanks are required for this process, so that while some are filling, others will be resting and others still emptying. To avoid unnecessary labor, a system is now in use by which the sewage, after the precipitant has been added, flows continuously through a series of tanks, so large that several hours are occupied in the passage.

In round numbers, about one ton of semi-fluid black mud will be precipitated from each 50,000 gallons of sewage of average character from American towns. This sludge contains about 90 per cent. of water which is difficult to dispose of. In some cases it is pumped on to porous land, allowed to drain or evaporate, and when hard enough to handle it is carted away or dug into the ground. In other cases it passes through presses of peculiar form, is reduced to about one-fifth of its former bulk, and left in the form of cakes, with about 50 per cent of moisture. The product in either case is almost valueless.

Sewage precipitation requires a somewhat expensive plant and a force of workmen; it is often necessary also to pump the sewage. As a rough approximation the

yearly cost of this process in England is about 37 cents per individual of the population whose sewage is treated. And owing to the higher cost of labor and material, the cost would be probably double in this country.

*Purification by Land.*—Sewage is not purified by any process of precipitation; it is, in fact, only partly deodorized, and is not fit to turn into any stream used as a source of water supply. But by applying sewage to land it can be purified both from its suspended impurities and from those in solution; in the present state of sanitary science, treatment by land is the only possible way in which this latter purification can be effected.

One-quarter part or more of the bulk of any porous earth consists of voids containing air. A part of the sewage water is evaporated from the soil, and the rest, as it sinks, spreads over every particle of earth in a thin film, and is thus brought into contact with the air contained in the ground. If 20,000 gallons of sewage filter evenly through an acre of land, where the ground water stands 6 feet below the surface, each gallon of sewage will be brought into contact with at least 25 times its bulk of air; the effect of this will be to oxidize and change organic impurities into harmless compounds, so that the effluent water will be inoffensive and innocuous.

The essential requirement is a large area of porous land, in which the ground water stands at least 6 feet below the surface, either by natural cause or artificial drainage. The land should be reasonably flat, and, if possible, low enough to permit the sewage to flow to it by gravitation. There are in England about 150 places where this method of treatment is pursued. At points visited by Mr. Clarke, the cultivation of the land seemed to interfere more or less with its use for purifying sewage. Sewage farms, as a whole, are rarely profitable; for the sewage must be disposed of at all times, when it only does harm as well as when it does good.

Land on which sewage is purified need not cause any nuisance. Earth is a good deodorizer. In England, Mr. Clarke noted numerous cases where the sewage farms were in the immediate neighborhood of dwellings and towns. Very little prejudice is now felt in England against the proximity of these farms. (The report shows phototypes of such farms and the dwellings about them.)

*Application of Methods to Massachusetts and Conclusions.*—The report continues by discussing the considerations effecting a choice of methods in Massachusetts. In regard to streams in Massachusetts, as a rule, they are larger than in England and the population on their banks less dense; consequently turning crude sewage into them would generally cause less pollution here than there. But England does not suffer from the prolonged droughts that at times effect this country, and crude sewage might at times cause a dangerous nuisance under our conditions of climate.

Clarification by chemicals is resorted to in England, usually in order to avoid great expense in securing land for purification by filtration. Lime and labor is much more expensive here, and the extent of the trouble caused bp freezing in the settling tanks can only be determined by experience with us. As a whole, the conditions seem less favorable with us, in this process, than in England.

Disposal on land is effected in England bv the cost of the area required, for English sewage farms usually cost from $500 to $1,500 per acre. Land here can be generally obtained for one-tenth of the sum. The conditions for this method are most favorable for Massachusetts.

The conclusions are that the proper disposal of sewage is always difficult and expensive; but the only practicable method yet discovered of purifying sewage is by its intermittent application to large areas of land The purification will be more effectually and more easily accomplished when the land is devoted solely to this purpose. And where sewage is to be treated in any way, it is better to keep it separate from the rainfall in a distinct system of sewers.

Part III of the report deals with the systems of sewage disposal recommended. In this portion the work is divided into, first, the natural drainage divisions, which are treated generally; and then, secondly, the detailed suggestions for each town or series of towns in the territory under investigation. Each system recommended is accompanied by an excellent map showing the location of the filtering area best adapted to its needs and conditions, a plan and profile of the sewer system, from the borders of the town at least, and an estimate of cost, or apportionment of cost. These detailed estimates give the size and length of sewer, depth of cut and approximate cost per foot.

For the Charles River valley, from Waltham to Boston, an intercepting sewer, 4½ feet diameter, is projected, to connect with the Boston main drainage. But for nearly all the smaller towns, and all those remote from the sea coast, filtration on land is provided for. An intercepting sewer is suggested for the future along the Neponset River valley.

## The Ohio Society of Surveyors and Civil Engineers.

The benefit derived from interchange of opinions among men of any profession is commensurate with the interest manifested by the individual members of the class, and the desire on their part, expressed in action, to give as well as receive.

Continually called upon and expected to solve satisfactorily, problems and difficulties in converting the forces of nature to the use of man, and to correctly determine the right course to be pursued in adjusting the claims as to boundaries of land, civil engineers and surveyors recognize this fact, probably as fully as any other class of men. Men engaged in extensive or very important service long ago formed societies for mutual help, and it has only been within a few years that surveyors and civil engineers, engaged in a mixed practice in the many counties of the thickly settled sections of the country, first began to associate themselves, and study together the best method of reaching the best results. But once started in the states, the idea has proved so practical and the benefits so obvious, that now, organizations of the kind have been formed, or are being formed, all over the Union.

About the first state organization of the kind was the County Surveyors' Association of Ohio. Difficulties in making it a success were met, and overcome, the organization better perfected for the accomplishment of its ends, the name changed, and now, no state organization is doing better work, or has brighter prospects for the future than the Ohio Society of Surveyors and Civil Engineers. Its officers study the wants of the members, and a fair indication of this can be seen on the programme of exercises for the Seventh Annual Meeting of the Society, which was printed in ENGINEERING NEWS for January 16th.

Programmes and invitations to the meeting had been sent to surveyors, engineers, and contractors throughout the state, and to many in other states. The attendance was large, and much interest was manifested in the work, not only by members but also by those who were attracted to the meeting and who were not members. The meetings of the Society were held in Hunt's Hall, No. 730½ North High street, Columbus, O. The Hall was probably the best the Society ever had for its meetings, although somewhat removed from the business portion of the city. Light, well-warmed and clean, without disturbance about it, all were enabled to hear the papers and discussions much easier than at some previous meetings. The Secretary's Report, read by Benjamin Thompson, Secretary, showed that exchanges of reports for the past year had been made with kindred organizations in Indiana, Michigan, Missouri, Nebraska and Connecticut, so that each member of the Society received what was equivalent to a large octavo of over 500 pages. The Society is endeavoring to form a library, and among the donations noted, was a complete set of the transactions of the American Society of Civil Engineers, donated by the Board of Direction of the Society (John Bogart, Secretary), and a valuable set of maps and reports by Captain F. V. Greene, of the Engineering Department of the District of Columbia. Frequent requests had been received for full sets of the Reports of the Society, and there were still on hand a small number of old reports. The report was accepted.

The Treasurer's Report showed that there were eighty-seven paid up members, and eleven delinquents.

The Board of Trustees reported that the books and accounts of the Treasurer were correct, and recommended the acceptance of the report, which was done. The Board also recommended an amendment to the Constitution by which all members of the Society who had never been in the actual practice of surveying and civil engineering, should be known as associate members. The amendment was adopted, and the following persons elected by ballot to membership in the Society.

MEMBERS—J. A. Hanlon, Massillon; Edgar H. Mark, in charge of Signal Service Bureau, Columbus; W. C. Gear, County Surveyor, Wyandott Co., Upper Sandusky; R. A. Bryan, City Engineer, Portsmouth; A. S. Mowry, Surveyor, Marysville; Edwin D. Haseltine, Surveyor and Civil Eng., Hazelton; Robert E. Lowry, Surveyor and Civil Eng., Eaton; John M. Ackley, Surveyor and Civil Eng., Brooklyn Village; Charles B. Cook; Architect and City Engineer, Chillicothe; Charles S. Lee, County Surveyor, Union Co., Marysville; James Pillars, County Surveyor, Allen County, Lima; W. W. Smith, Civil Engineer, Maple P. O.; Edward S. Mendenhall, Dep. County Surveyor, Delaware; Samuel Nighswander, Surveyor and Civil Engineer, Tiffin; A. T. Bement, R. R. Engineer, Toledo, all of Ohio; John B. Johnson, Prof. of Civil Eng., Washington University, St. Louis, Mo.

ASSOCIATE MEMBERS.—Thomas L. Johnson, Dealer in Math. Inst's., Philadelphia, Pa.; Arthur H. Smythe, Dealer in Math. Inst's., Columbus, O.

The report of J. D. Varny, delegate appointed to attend the Cleveland Convention of Civil Engineers, was read, and after a short discussion in which no opposition was shown, the action of the Convention was adopted, and the following members of the Society were elected a committee on National Public Works, viz.:—E. D. Shreve, Bucyrus, O.; J. D. Varney, Cleveland, O., and Benj. Thompson, Urbana, O. The committee organized by making Mr. E. D. Shreve chairman.

Professor Edward Orton, of the Ohio State University, gave an instructive lecture on the geological formation of Ohio, illustrated by references to an excellent geological map of Ohio.

A paper on "Connected Levels in Ohio," was read by C. N. Brown, Assistant Professor of Civil Engineering at the Ohio State University. The writer explained the advantages which a system of connected levels over the State would be to the geologist, to engineers, and to the Weather Bureau, and outlined a plan by which the members of the Society could make a united effort to accomplish the desired result. After some discussion, a committee, consisting of Mr. C. N. Brown, Mr. E. K. Mark, in charge of the Signal Service Office at Columbus, and Mr. W. H. Jennings, Chief Engineer C. H. V. & T. Railway, were appointed to perfect a plan and prepare instructions to be followed in undertaking the work.

Mr. E. D. Shreve, of Bucyrus, Chairman of the Committee on Drainage, presented the report of the Committee. From an extensive correspondence and personal observation over a wide field, it was safe to say that no such advancement in drainage matters was ever made in one season as during the past year. Advancement in drainage enterprises at this time means an increase of knowledge and a growth of sentiment among vast bodies of people. Laws relative to drainage have been overhauled and improved. Tile drainage is becoming very common, rendering unnecessary many open drains with the accompanying loss of use of ground. Yet each has its place, and cannot be supplanted. No higher compliment can be passed on those who evolved, and gave weight and unquestioned authority to the ditch laws of Ohio, than to call attention to the fact, that no greater

achievements have ever been attained among any people by internal improvements than has been already attained in Ohio. The entire northwestern part of the State has been transformed from a wilderness of woods and swamps, into a productive section of country. No instance has been reported where benefits derived have not far exceeded the cost. Yet the maximum benefit was not often secured because the engineer is compelled to proportion the improvement according to the paying ability of the land-owners. The remedy for over-coming the filling up of ditches by silt is to make them deeper; simply cleaning them out has failed. The action of sediment on changes in form of channel, slopes, widths, and curves received attention. Under-draining is the best preventive of trouble; tile drain the public highways, roads, streets, alleys and lanes; convert small open ditches into large tile drains; then make deep wide channels for outlets. More care must be taken in locating the route. The action of the last Legislature in giving Commissioners authority to sit in judgment on their own proceedings was absurd, a trick and a snare gotten up by attorneys to win a case.

Mr. E. B. Opdycke, of Bryan, O., read a continuation of his paper of last year on "The Problem of the Just Apportionment of the Cost of Ditch Improvements." It would be too much to try to give a proper abstract of this very valuable paper. The author takes up the subject where he left it last year, considers the difficulties met in apportioning the cost, gives the results of his own investigations, forms of field book best suited for showing just what the engineer has done, and why he did so, and follows the ditch in all its bearings, so far as the engineer is concerned in apportioning the expense, to the end. Taken with its predecessor of last year, the paper is probably the most complete one on the subject, that has been prepared up to this time.

Mr. J. S. Ellis followed with a paper on Open Drains—"their size, grades, widths, and slopes." Mr. Ellis has been actively engaged in drainage improvements for a long time, in a very flat portion of Ohio, and he considered the subject in a very practical manner, discussing the results of the experiments of noted engineers, and his own investigations and experience, and stating conclusions which he had finally determined upon.

A special session was devoted to the discussion of the papers. The experience of those present proved the great success attendant upon the use of large tile in place of moderately sized open ditches.

Beginning with the papers on Land Drainage read at the Fifth Annual Meeting of the Society, and taking in the papers read on the same subject at the sixth and seventh meetings, the series cannot be excelled by any others on the same subject, published in this country. It is the intention to continue the subject next year, when probably more attention will be given to tile drainage.

Mr G. S. Innis, of Columbus, O., in his paper on "Land Surveying," took into consideration first the transit, then the steel tape, prefers the 66 foot tape divided into links for farm surveys. The starting point and how to find it, the planting of permanent monuments, setoffs, samples of field notes, obstructions, constructions of deed descriptions, the plat, and the calculation of area, each was treated in turn.

The paper on "Land Marks, Ancient and Modern," was read by J. T. Buck, of Carding ton, O. After recounting the old monuments of the world, Mr. Buck describes his method of marking a corner in such a way, that it can be found, although visible surface marks are gone.

The report of the Committee on Land Surveying was presented by Mr. J. D. Varney, Chairman of the Committee. A large number of problems had been submitted to them, and the report submitted the conclusions of the members or the committee. The time necessary to properly discuss them, necessisated the calling of a special session, and even then the work was not completed for lack of time. The problems will all appear in the annual report. The committee had also been gathering statistics during the year with reference to monuments required by law, and other matters pertaining to land surveying.

The paper on "Roads and Canals of Ohio," was read by the author, Mr. D. W. Pampel, of Sidney, O., who gave a carefully prepared description of the method by which the roads of the state can be and are converted from an impassible condition during a great portion of the year into highways that can be travelled at any season of the year with speed and comfort. In other words, he described how he makes what are known as "Improved Roads" in Ohio, by grading, draining, bridging, culverting, and graveling. In his opinion, the canals have outlived their usefulness, and ought to be done away with.

The discussion on the canals was about equally divided, *pro* and *con*, but evidently the members of the society were not fully prepared to take sides on the question.

The Report of the Committee on Civil Engineering was read by Mr. R. S. Weitzell, Chairman of the Committee, and was mostly in reference to the method by which the work expected of the Committee could be best secured.

The report of the Committee on Highways was simply referred to by the Chairman, Mr. D. W. Pampel. The work of the Committee had been devoted to the gathering of statistics, relative to number of miles of improved road in Ohio, dimensions of grade, and gravel covering, cost of construction and superintendence, miles, plank road, toll pike, number of bridges, spans, capacities, etc. etc. This report was tabulated, and will appear in the printed proceedings of the Society. In the discussion, the under-drainage of improved roads, the use of broken stone for road metal, and relative cost were brought out.

In the election of officers, Mr. W. H. Jenning, Columbus, O., Ch. Eng.; C. H. V. & T. Ry., was elected President, Mr. E. D. Shreve, Bucyrus, O., Engineer Bucyrus Foundry and Mfg. Co., Vice-president; Benj. Thompson, Urbana, O., Secretary and Treasurer; F. J. Sager, Marysville. O., Ch. Eng. Cleveland and Marietta R. R., Chairman of the Board of Tustees. The other members are the President, Vice-President, E. B. Opdycke, Bryan, O., F. M. Davisson, West Manchester, O.

The Committee on Blanks and Instruments succeeded nobly. According to manufacturer's prices, the mathematical instruments displayed amounted in value to about $4,000. Samples of all kinds of blanks were to be found on the tables for distribution, and the walls of the room were lined with maps, plans, drawings, photographs, etc.

During the meeting very neatly designed and printed cards were received from the Columbus Sewer Pipe Company, of Columbus, inviting the members of the Society to visit their works. The invitation was accepted and those who had never seen sewer pipe constructed had a very enjoyable and profitable trip. Mr. Charles Sturgeon, the gentlemanly General Agent, conducting the members from the field where the clay was dug, through the buildings showing all the processes, until the pipe was filed in the yard ready for shipment.

The death of J. S. Bundy, member of the Society was announced, and a committee appointed to draft suitable resolutions.

Several papers, crowded out, will appear in Report. Communications were read from other Societies, and Mr. F. J. Sager, and Mr. E. D. Shreve were appointed delegates to attend the meetings of Societies in Indiana, Michigan, Illinois and Nebraska.

The meeting was the most successful the Society ever had, and until the last hour of the meeting, new arrivals were constantly coming in. At the close, the Register which was very incomplete, showed that the following persons had been present.

Benj. Thompson, Secretary, Urbana; N. Koehler, C. E., A. G. Pugh, C. E., B. F. Bowen, C. E., E. F. Kinnear, Dep. Co. Surv., D. D. McDowell, Agt. Wasson Fire Clay Co., C. N. Brown, Asst. Prof. C. E., O. S. U., F. H. Beverly, Edward Orton, Prof. Geology, O. S. U., W. H. Jennings, Engr. C. H. V. V. T. R., G. S. Innis, A. H. Smyth, Dealer in Math. Instruments, A. O. Jones, Tile Manufatcurer, C. C. Pomeroy, C. E., Ellis Lovejoy, M. E., G. M. Boggs, Asst. Engr., C. H. V. & T. Ry., all of Columbus; James Pillars, Co. Surv., Lima; Geo. R. Gyger, Surv., Homeworth; J. Arnett, Surv., London; J. D. Varney, Surv. Cleveland; J. T. Buck., Surv., Cardington; E. M. Miller, Co. Surv., Greenville; F. J. Sager, Ch. Engr. C. & M. P. R., W. T. Guy, Asist. Engr., Iron Substructure Co., both Marysville; E. B. Opdycke, C. E., Bryan; E. W. Dimock, Co. Surv., Ottawa; J. A. Hesbrook, Co. Surv. Cincinnati· H. L. Weber, City Engr., Bucyrus; Wm. Reeder, Co. Suvr., London; J. V. Cuff, Liberty Center; L. B. Fraker, Co. Surv. Wauseon; J. L. Guyer, State Representative & C. E., Paulding; E. D. Haseltine, C. E., Youngstown; John P. Haller, S. C. E., Lima; J. A. Mattoon, Co. Suvr., Bryan; Chalkley Dawson, C. E., Bellaire; Charles S. Lee, Co. Surv., Marysville; C. Buxton, Ch. Engr., T. & O. C. Ry., Toledo; B. J. Ashley, C. E., Mt. Gilead; J. L. Fisher, C. E., Tiffin; J. S. Ellis, Drainage Engr., Perrysburg; E. D. Shreve, C. E. & M. E., Bucyrus; F. M. Davisson, C. E., West Manchester; R. Gray, Bloomington; James Ireland, Surv., Morrow; W. B. Jones, C. E., Van Wert; R. M. Haseltine, C. & M. E., Haselton; Fred. J. Barth, Dep. Co. Surv., Bucyrus; Chas. B. Cook, City Engr., Chillicothe; Philip Patermann, Co. Surv., Loramieas; H. B. Vanalta, Asst. C. B. V. & T. Ry., Nelsonville; John H. Holl, City Engr., Canton; L. E. & W. F. Gurley, Inst. Mfrs., Troy, N. Y.; F. Hodgman, Co. Surv. & Civ. Engr., Climax, Mich.; T. L. Johnson, Representative Jas. W. Queen Co., Philadelphia; T. S. Weitzell, Engr., Raccoon Coal Co., Starr; A. J. Norton, C. E., Bellaire; R. E. Lowry, Co. Serv., Eaton; W. C. Row, Co. Surv., Circleville; J. R. C. Brown, Co. Surv. & City Engr., Ironton; Samuel Bell, Co. Surv., Manon; L. Beckman, Inst. Maker, Toledo; W. B. Hanlon C. & M. E., Bridgeport; J. R. Wright, Co. Surv., Georgetown; J. C. Wonders, C. E., Bellefontaine; W. H. Gaffrey, Logan; T. E. Buck, Cardington; W. C. Gear, C. E., Upper Sandusky; J. S. Dike, Delaware; J. B. Strawn, C. E., Salem; Frank A. Bone, Co. Surv., Lebanon; Frank C. Osborne, with Keystone Bridge Co., Pittsburg, Pa.; W. J. Struble, Mt. Vernon Bridge Co., Mt. Vernon; W. H. Hendren, Groveport; T. L. Randolph, Inst. Mfr., Cincinnati; Wm. Sharon, C. E., Springfield; P. H. Dogle, Engr. Corps C. H. V & T. Ry., Logan; F. M. Priest, C. E., Bryan; N. A. Sager, Asst. Engr., T. & O. C. Ry., Toledo; D. W. Pampel, C. E., Sidney; W. M. Sharon, C. E., Springfield, all of Ohio.

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**The Uncompahgre Canal Company** of Colorado have decided to build at once two laterals on the Cushman mesa, each from three to six miles in length. They will be built by contract, and will make employment for a number of men and teams.

### Progress on the Upper End of the New Croton Aqueduct.

We have obtained from Brown, Howard & Co., contractors on the New Croton Aqueduct, from Shaft Zero to Shaft 11 B, the following data relating to progress made on their work:

**Depth of Shafts, Distance of Headings, Bench and Track, From Center of Shafts, January 1, 1886.**

| Shafts. | Heading. | Heading. | Bench. | Track. | Depth of Shaft. | Portal. |
|---|---|---|---|---|---|---|
| 11 B. | South | 1618 ft. | 1604¼ ft. | 1582 ft. | 60 ft. | |
| 11 A. | North | 1828 | 1815⅝ | 1792¾ | 56½ | |
| 10 | North | 1030½ | 1001½ | 956 | 151 | |
| 10 | South | 968½ | 938½ | 899 | | |
| 9 | North | 904 | 824 | 823 | | 1100 ft. |
| 9 | South | 1563¼ | 1510 | 1492 | | 200 |
| 7 | North | 668 | 650 | 618 | 188 | |
| 7 | South | 626¼ | 602 | 578 | | |
| 6 | North | 326½ | 306 | 261 | 205 | |
| 6 | South | 295¼ | 277¼ | 227 | | |
| 5 | North | 964 | 949 | 930 | 140 | |
| 5 | South | 762 | 744 | 715 | | |
| 4 | North | 679 | 643 | 604 | 272 | |
| 4 | South | 585 | 553 | 507 | | |
| 3 | North | 76 | 54 | 40 | 375 | |
| 3 | South | 91 | 67 | 45 | | |
| 2 | | | | | 375 | |
| 1 | North | 160 | 124 | 128 | 260 | |
| 1 | South | 163 | 120½ | 90 | | |
| 0 | North | 1388 | 1348¾ | 1323½ | 296 | |

**Progress of Work During Month of December, 1885.**

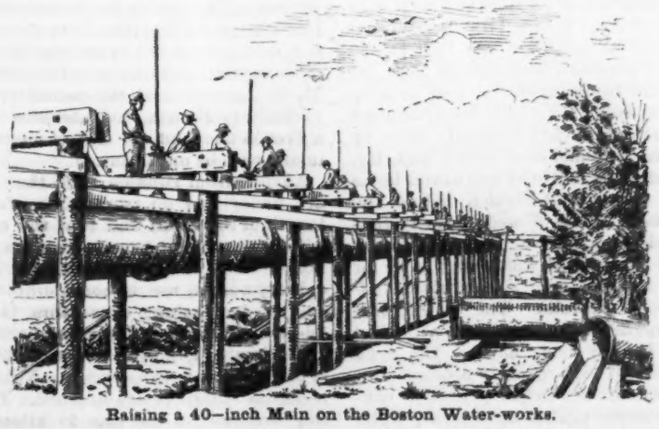
| | Heading. | Shaft. | Heading. | Bench. | Track. | Foreman. |
|---|---|---|---|---|---|---|
| 1st. | South | 9 | 267 ft. | 250 ft. | 261 ft. | Harry Quinn. |
| 2 | North | 11A. | 213⅜ | 212½ | 212½ | J. E. Stephens. |
| 3 | South | 11B. | 211½ | 212½ | 210 | J. E. Stephens. |
| 4 | North | 4 | 209 | 208 | 202 | Harry Stephens. |
| 5 | North | 10 | 201 | 186 | 192 | Wm. W. Dashiel. |
| 6 | North | 6 | 185⅛ | 196⅜ | 216 | John Downey. |
| 7 | North | 7 | 184 | 188 | 187 | Thos. Connell. |
| 8 | South | 0 | 164 | 201 | 169⅜ | Th. Biglan & W. D. Andrews. |
| 9 | South | 7 | 177½ | 175 | 174 | Thos. Connell. |
| 10 | South | 10 | 163½ | 164 | 157 | Wm. W. Dashiel. |
| 11 | South | 6 | 163½ | 162⅛ | 182 | John Downey. |
| 12 | South | 5 | 160 | 159 | 164 | Michael Nolan. |
| 13 | North | 5 | 150 | 163 | 165 | Michael Nolan. |

**Progress of Work for Week Ending Sunday Morning, January 10, 1886.**

| | Heading. | Shaft. | Heading. | Bench. | Track. | Foreman. | Shift Bosses. |
|---|---|---|---|---|---|---|---|
| 1st | South | 5 | 66 ft. | 54 ft. | 51 ft. | M. Nolan. | Jno. Beeley and Wm. Golden. |
| 2 | North | 4 | 65 | 48 | 47 | H. Stephens. | W. Robins and R. Hooper. |
| 3 | South | 9 | 60 | 53 | 54 | H. Quinn. | Jas. Quinn and Robt. Addison. |
| 4 | South | 0 | 57 | 52½ | 48 | T. Biglan. | T. Biglan and W. D. Andrews. |
| 5 | North | 11A. | 52 | 49½ | 37 | J. E. Stephens. | Joe. Biney and Wm. Carey. |
| 6 | South | 10 | 54¼ | 36 | 52 | W. W. Dashiel. | P. O'Connell and T. J. Davis. |
| 7 | North | 10 | 46 | 52 | 72 | do. | Jas. Carter and Joe. Hanlan. |
| 8 | South | 7 | 45 | 51 | 48 | T. Connell. | Jas. McHale and Joe. Hampshire. |
| 9 | North | 6 | 45½ | 50 | 35 | John Downey. | Pat. Feeney and Wm. Monahan. |
| 10 | South | 6 | 40⅜ | 54 | 21 | do. | Jno. Jewell and Matt Jewell. |
| 11 | South | 11B. | 48 | 45 | 52½ | J. E. Stephens. | W. Reardon and W. McDonald. |
| 12 | North | 7 | 45 | 46 | 34 | T. Connell. | M. McKenzie and D. McLeod. |
| 13 | South | 4 | 51 | 38 | 61 | H. Stephens. | P. Whalen and Thos. Weldon. |
| 14 | North | 9 | 45 | 31 | 46 | H. Quinn. | T. Connors and Jas. McManis. |
| 15 | North | 5 | 41⅛ | 34 | 46 | M. Nolan. | Ed. Dorsey and Pat. Kane. |

### Lifting a 40-inch Water-Main.

The sketch below, reproduced from a photograph, shows the general method adopted for lifting a 40-inch water-main on Brookline avenue, in Boston, Mass.



Raising a 40—inch Main on the Boston Water-works.

The work, which was commenced in June, 1884, included the raising of 1,000 feet of this main from 0 to 18 feet, to adjust it to a new grade in the avenue. The plan pursued by the Boston Water Department was about as follows:

After the pipe was uncovered, piles were driven in pairs on each side, 5 feet 6 inches apart, and in bents 12 feet apart; the pile-heads were then tenoned, and a cap made of two pieces of 4 by 12-in stuff was bolted on as shown, and the bents stayed longitudinally. The lifting was done, with the pipe empty, by screws 8 feet long working in square nuts resting on a broad iron plate on the cap pieces. After all preparatory work was completed, the lifting of the pipe to its new position was accomplished in about nine hours.

After the pipe was raised, two more 4 by 12-in pieces were bolted to the piles just under the pipe, and the bottoms of the piles were cross-braced. Stringers made of two 6 by 12-inch timbers were then placed on the caps, and a track of standard gauge put into place, upon which the dump cars used in filling the avenue were run out.

The engineer-in-charge was Mr. Dexter Brackett, and we understand from him that a 48-inch main is to be raised in a somewhat similar manner during the present year.

### THE HISTORY AND STATISTICS OF AMERICAN WATER WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.; M. INST. C. E.

794.—OSHKOSH, WISCONSIN.

Oshkosh, Winnebago county, Wisconsin, in lat. 44° N., long. 88° 40′ W., on Lake Winnebago at the mouth of Fox river, is on a nearly level prairie, the ground not rising anywhere more than 20 feet above the lake. Settled in 1843, it was incorporated a city in 1855.

Water works were built by a private company in 1884, after plans of McRitchie & Nichol, C. E., taking the supply from three bored wells, 2 to 5 inches diameter and 500 and 300 feet deep and one of 8 inches diameter and 150 feet deep. Water is found in the rock at 105 feet below the surface, and rises to about 100 feet above the surface. The three wells discharge about 2,500,000 gallons a day into a reservoir 75 by 150 feet and 17 feet deep, excavated in clay and paved with dry stone. From this, which is 4 feet above the lake level, the water is pumped directly into the mains, by two compound duplex Gaskill steam pumps of 9,000,000 gallons daily capacity. The ordinary pressure is 40 lbs. and the fire-pressure 100 lbs.

Distribution is by 22 miles of cast-iron pipe of 6 to 16 inches diameter, with 206 fire hydrants, 20 gates and 120 taps. Service pipes are of lead and galvanized iron. The town pays $14,360 per year for hydrant service.

The cost of the works was $250,000. The capital stock of the company is $200,000. The annual cost of maintenance is about $8,000. George W. Russell is Secretary and W. D. Harshaw the Superintendent.

The population in 1880 was 15,748 and is now said to be 21,000.

NEW OUTLET FOR THE LEHIGH VALLY.—BUFFALO, Jan. 21.—President Wilbur and General Agent Sayre of the Lehigh Vally Railroad have been in consultation here with their attorney, Wilson S. Bissell, all day. This afternoon the facts regarding a new line which is to be their western outlet were made public. A company has been incorporated under the name of the Buffalo and Geneva Railroad, to build a line between the places indicated, a distance of 100 miles. The capital stock is $1,000,000. The directors are W. W. Wright, Stwart S. S. Cobb and Joseph F. Lewis, of Geneva; M. A. Wilbur, of Victor; S. D. Jackson, of Clifton Springs; S. R. Pratt, of Manchester; Howard Elmer, of Waverly, and Wilson S. Bissel, F. H. Goodyear, J. W. Bridgeman, Howard H. Baker, Arthur D. Bissell, and Franklin Lee, of Buffalo. The election of officers takes place here to-morrow.

PHILIPSBURG, N. J., will build water-works on the "Marble Hill Plan," which means a reservoir of 2,000,000 gallons capacity at an elevation of 285 feet, and supplied by an engine that can fill it in twenty-four hours pumping from the Delaware river. The contract for the pipe has been let, and the engines only remain to be decided on. The company will probably lay the pipe itself, and contract the reservoir, engine-house engines, etc. The works complete, are estimated to cost not over $80,000. They will probably be in operation by July or August.

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TO SUBSCRIBERS.

The date of expiration of subscriptions is given on the printed address-label attached to each copy of this paper, and is, we trust a sufficient notice to all parties proposing to renew for the ensuing year.

A NEW field for contractors is rapidly developing in the drainage districts of Ohio and Illinois. The vigilance of our special correspondents in these states has made public the extensive schemes of improvement in this direction and its fruit is apparent in the advertisement of the Drainage Commission of Ashkum and Danfurth, in Iroquois Co., Ills. We have no doubt that, as soon as the magnitude of these drainage operations are fully appreciated that there will be some lively competition among contractors for the profits of construction. ENGINEERING NEWS will in this, as in other fields of contracting, maintain its acknowledged leadership as the best medium for reaching interested parties.

THE Annual Convention of the American Society of Civil Engineers, and the opening of bids for constructing sections 12, 13, and 14 of the Croton Aqueduct attracted a very liberal representation of civil engineers and contractors to this city during three days of this week. Elsewhere we give abstracts of the meetings of the former, and the bids of the latter, together with names. Imagine this combination of men, supplied with unlimited funds, and turned loose on community to "improve" the continent. We can almost hear the agonizing cry of old Mother Earth as she anticipates the severe handling she would be subjected to.

THE report of Superintendent McMinn, of the Williamsport, Pa., Water Works, gives some interesting items of information on the subject of water supply, and it is the accumulation of just such information which gives one person the superiority over another in the race for preferment. We hope to have more such reports sent us.

H. KATO, President of the University of Tokio, Japan, informs us that his institution especially desires to obtain as complete a collection as possible of all trade catalogues, advertising circulars, etc., connected with engineering work.

We trust that our readers who are interested in the engineering manufactures of this country, will at once comply with the above reques There is no telling what lusty oaks may grow from acorns so scattered.

*The Engineer* has copied (without giving us credit therefor) the substance of our article of November 21st last "*The Export of Locomotives.*" After setting forth their number and their value for the fiscal year 1884 ($2,819,-946) it adds, in apparent unhappiness:

"It seems very remarkable that countries oppressed with heavy protective duties should be able to compete so successfully with free trade England. Political economists would do well to supply an explanation."

This does not seem a case for scholastic theories. The facts are that England has pig iron $4 to $6 cheaper, coal lower and wages not over 60 per cent. of what we pay. Yet in the case of the New Zealand locomotives our manufacturers built them for 20 per cent. less than the English offer, and Sir Julius Vogel said they were better than the English engines, and in general, in spite of higher wages, higher cost of raw materials and capital, we almost invariably beat our "mother competitor" both in quality and price in such manufactures as by our circumstances have been forced into activity with us, as for instance, locomotives, rolling stock, bridges, pumps, tools, shelf hardware, locks, agricultural implements, cotton goods and the locating, building and management of railroads.

These facts, it is submitted, are not for professors and doctrinaires but for business men to investigate on business principles. The present attempt to reduce British wages, resulting, as it will, in still further decrease of intelligence and application, is not a step in the right direction.

OUR special correspondent to the New Orleans Exhibition is not very enthusiastic over what he saw there. It is to be regretted that the exhibitions of last year and this at the Crescent City were so incomplete in their organization, and consequently so very unsatisfactory. The results must have been premised by the projectors as they certainly were by everybody else who had ever visited that city. Notwithstanding its celebrity as a winter home of southern wealth and fashion before the civil war, where money flowed so freely that no copper coin was known, yet no provision was made for an efficient water supply, or for sewerage or street paving, a condition of affairs which still prevails. The people still draw their supplies from the mosquito infested water-tanks behind their houses, the open sewage canals still send up their noisome protest; the streets are yet in the primitive condition of a frontier prairie settlement, while the unceasing lottery wheel keeps turning under the patronage of a distinguished officer of the late Confederate army, and the gamblers run the municipal Government. And the "cry from Macedonia" is "come and help us," with your abundant northern capital and energy and industry, while the citizens "chew their quids," with the same old hopeless, nerveless helplessness of old. There are many liberal-minded, ambitious, enthusiastic men of progress in New Orleans, but they are so terribly handicapped that nothing short of a revolution of some kind will ever place them at the head of affairs and make their city the great commercial center they are struggling for.

*The Iron and Coal Trades Review* gives the following summary of the launches in Great Britain during the year 1885 :

| Name of port. | No. of firms. | No. of vessels. | Gross tons. |
|---|---|---|---|
| The Clyde | 48 | 241 | 193,458 |
| The Tyne | 19 | 105 | 102 998 |
| The Wear | 14 | 45 | 61,771 |
| The Tees | 5 | 57 | 34,338 |
| Hartlepool | 2 | 18 | 33,030 |
| Belfast | 3 | 17 | 27,755 |
| The Mersey | 5 | 40 | 27,756 |
| Southampton | 1 | 10 | 19,192 |
| Leith | 5 | 27 | 8,727 |
| Aberdeen | 2 | 7 | 7,399 |
| Dundee | 4 | 13 | 7,357 |
| Hull | 1 | 12 | 6,191 |
| Barrow | 2 | 4 | 4,058 |
| Workington | 1 | 1 | 1,860 |
| Maryport | 1 | 1 | 1,518 |
| Grangemouth | 1 | 7 | 1,500 |
| Blyth | 1 | 3 | 1,215 |
| Chepstow | 1 | 3 | 308 |
| Newport | 1 | 3 | 90 |
| | 112 | 614 | 540,282 |

This, at £20 per ton, is equal to about $54,-000,000, any part of which would have been extremely pleasant to our laboring or transporting interests. England, that, in 1883, launched vessels that sold for $93,000,000, on the contrary, does not feel particularly rich over the decreased output.

### Panama Canal.

*The Railway News* in a leader on this subject reports that at the last meeting of the shareholders, M. de Lesseps acknowledged that the enterprise presented difficulties that must be faced by fresh efforts. The scheme for lottery bonds having failed through the opposition of the Crédit Foncier, the Government resolved at the request of the canal company to send a distinguished engineer, M. Rousseau, to examine the works and see whether they could be completed.

Objections to this step are made—either M. Rousseau's report will be adverse, in which case the enterprise will be annihilated, the responsibility falling on the Government, or, if favorable, the Government acting on the advice of its agent, will sanction the loan, thus becoming responsible for the success of the project and accepting the necessarily involved international difficulties. On the other hand, it is said to be better to prevent the loss of any more capital, and owing to the persistency of M. de Lesseps and the capital being almost exclusively French, the enterprise is virtually a French one, and the Government could not in any case be unconcerned.

Advices from Panama state that operations are under way on two thirds of the entire length of the canal and that the other third will be the easiest to construct, as it is composed of soft earth only. The amount of machinery now in use is considerable and constantly increasing; excavators for the Culebra section now being disembarked, which are estimated to be able to excavate the bulk of that section in three years. Nearly all the requisite buildings are finished. The American dredges on the first 20 kilometres are working to their full capacity. The number of laborers employed is 12,000; this number to be doubled during the dry season; 450 men in hospitals. Small damage was experienced from inundations in the Chagres.

### The Proposed Congo Railway.

The news from Brussels is that a contract has been signed giving the concession for the construction of a railway connecting the Upper and Lower Congo, to the Congo Railway Company of Manchester. Subscriptions will shortly be opened in the capitals of the fourteen States who participated in the Congo Conference at Berlin.

The capital stock proposed is £2,000,000; of this Mr. H. M. Stanley writes in substance, according to *Herapath's Journal*, that the sum of £2,000,000 is undoubtedly very large, but the Congo Railway Syndicate has no idea of expending it, the proposition being to have the power of increasing the capital to that amount, should circumstances demand it. For the present only the traffic in sight or within reasonable expectation is to be dealt with, and the first issue is limited to £1,000,000.

The project as outlined by Mr. Stanley is to build two sections of railroad, one fifty miles long separated by eighty-eight miles of good navigation from the upper section, which is to be ninety-five miles long. He has found a practical engineer and contractor who is willing to contract for the first fifty miles at £2,400 per mile, or £120,000 for the entire section, and he was willing to supply the steamers, iron piers, and the several stations, sheds, and magazines for a sum of £70,000 more. We do not know how much is implied by "steamers, iron piers," etc., nor do we see any mention of rolling stock, but we advise the "practical engineer and contractor," to be very careful about his contract, if he takes the railroad at the figures mentioned.

The second section, of ninety-five miles, is estimated at £3,000 per mile, or £285,000 for the entire section, so that "we shall have arrived at Stanley Pool with one line of through communications from the sea by rail and steamer at a total expenditure of £475,500." This seems to be one of the estimates that it is well to add 10 per cent. to and then double.

The resources of the road are stated by Stanley to be the sum of £52,000 paid annually for porterage of goods and merchandise from the Lower Congo to Stanley Pool; the guarantee of the Congo State Government to expend a minimum of £10,000 per year on the state traffic for ten years after the completion of the road to Stanley Pool, and a concession conferring 40 per cent. of the customs export duties; that these are not all we judge, as a list of concessions is promised shortly, which list might mention the probable amount of customs export duties.

Since Stanley wrote "The Congo and the Founding of its Free State", when he estimated 5,250 miles of uninterrupted navigation above Stanley Pool, additional discoveries have been made increasing it to about 7,000 miles. The porterage of £52,000 above referred to is paid by the Congo State authorities, the French possessions, the Livingston Inland Congo Mission, the Baptist Mission, the Roman Catholic Missions and the native ivory traders.

The Syndicate, constructed largely of Manchester material, is to have its headquarters in London, and *Herapath's* thinks that the fourteen states joining in the Berlin Conference, should subsidize "a project which promises to bring civilization to the darkest stronghold of barbarism." The *Railway News* gives the project substantial endorsement putting in the proviso: "But unless all parties agree that the administration of the railway shall be placed in efficient hands with undivided responsibility and control, the company may retain its international character, but it will do so at the risk of disappointment and failure as a commercial undertaking. We presume that this matter of management of the railway has been fully considered by Mr. Hatton, one of the Members for Manchester, and chairman of the Manchester Chamber of Commerce, Lord Aberdare, Sir James Fergusson, Sir Henry Roscoe, Mr. Holdsworth, and Mr. Jacob Bright, who have associated themselves with Mr. Stanley in the carrying out of the project." Adding, the project seems to have a very fair chance of success, "assuming that its affairs are administered by men of experience with an eye to practical commercial results rather than animated by the mere sentimental desire to improve the condition of the natives, and develop the resources of the newly formed State."

All this is extremely gratifying, in anticipation at least, to the manufacturers of Manchester, but the *Kreuz-Zeitung* warns German capitalists against the whole scheme making the points that the Congo railways are being promoted by the Manchester Company, and the project is not laden with good to the Germans.

It might now be in order for our consular agent, who reported that there was no trade to be expected from the Congo, to rise and explain. Asserting to a possible rival that there is no profit in the business, is an old trick that any one knowing enough to be trusted to cross the ocean alone should have seen through.

### The Poughkeepsie Bridge.

This project which has lain dormant since 1878 is again revived by the election of a board of directors which organized by electing J. H. Appleton of Springfield, Mass., President, E. J. Sterling, Secretary and J. M. Jackson, Treasurer, both the latter of New York. The company's office is No. 7 Nassau Street.

This company was organized with Mr. P. P. Dickinson chief engineer, to bridge the Hudson at Poughkeepsie where the river is 2,430 ft. wide; five spans of 525 feet each were proposed, and the piers were expected to reach the respective depths, counting from the west side, of 97, 112, 112 and 122 feet passing through mud, sand, clay, etc., to hard pan and bowlders. The plan adopted for the foundations which was successfully employed in the case of the two western piers, was a crib 100 × 60 feet in plan, built of 12 inch × 12 inch timber and having three longitudinal cutting edges and seven tranverse ones; this arrangement gave two rows, of six each, of pockets open from top to bottom that were 12 × 12 feet, and twenty-eight pockets of smaller size that were closed at the bottom; the latter were filled with concrete and assisted in sinking the crib; the material was removed with a clam shell dredge through the 12 × 12 pockets. It was found practicable to govern the sinking with great ease by dredging in the different pockets, and the only work under compressed air was done by a diver who went down to examine the bottom before commencing to fill the pockets; this was done with the same clam shell buckets that excavated the material.

The crib stopped 20 feet below high water, and the masonry pier, which stood on forty columns of concrete, was started in a coffer-dam. The piers, which were to have been 135 feet above high tide, were only brought a few feet above water when the work was suspended.

It was proposed to build, in connection with this bridge, the Poughkeepsie and South Western R. R., connecting with coal roads in this State and Pennsylvania. To the eastward, the bridge would, through the Poughkeepsie, Hartford and Boston 40 miles long and by the Hartford and Connecticut Western 76 miles connect with Hartford and roads centering there. By building a short branch from Tariffville, on the Connecticut Western, to Springfield, Mass., the area over which they could distribute coal would be greatly increased.

### Basic Steel Patents.

The litigation between the parties controlling the Thomas-Gilchrist & Reese patents for using basic converter linings in making steel by the pneumatic process from ores containing phosphorus, seems definitely settled by a decision in favor of Reese by the Commissioner of Patents, dated December 16th, 1885.

The Thomas-Gilchrist patents, in this country, were sold to a combination of Bessemer steel makers, who so far have only used the acid process. It is understood they charged a royalty of $1 per ton on all steel made by that process, and as this exorbitant price, with steel rails at from $26 to $35 per ton, was prohibitory of its use in Alabama, where the ores are not fit for steel making by the acid process, it looks as if the patents were bought to retain the manufacture of steel in the present combination, and very little sympathy will be expended on the losers in the litigation.

### Annual Meeting of the American Society of Civil Engineers.

The Annual Meeting of the American Society of Civil Engineers convened at the House of the Society, 127 E. 23rd. St., New York, at 10.30 A. M. on Wednesday, with a large number of members present, President Graff in the chair.

The first business transacted, after the appointment of tellers to canvass the vote for officers for the year 1886, was the report of the Board of Direction; the Board reported that 74 new members had been elected during the year; the loss was, from death 12, resignations, 5, and dropped from the roll, 4. The present total membership of all classes was now 928. The report further gave in a general way the progress of the Society, and especially dwelt upon the good work accomplished at the Annual Convention held last June at Deer Park, Md. The published Transactions of the Society for 1885 contained 162 pages more of matter than those of any previous year, and the Library had been increased by the presentation and purchase of 709 books and pamphlets, and 531 maps, charts, plans and engravings of various kinds. Twenty-two meetings were held during the year, including in these the Annual Meeting and Convention.

J. Jas. R. Croes, the Treasurer of the Society, then read his report for the fiscal year, showing the Society to be in a very satisfactory financial condition; and the Finance Committee then certified to the proper auditing of all bills and the condition of the funds and securities.

The Committee on the award of the Norman Medal for 1885 announced that in their judgment this medal should be given to Paper No. 300, "A Record of Cement Tests," by Eliot C. Clarke, of Boston. The Committee on the Rowland Prize for 1885 awarded it to Paper 295, "Experiments upon Journal Friction at Low Velocities," by A. M. Wellington. The Meeting approved of both of these awards, and they were so granted.

The place of meeting of the Annual Convention of the present year was then taken up. Letters were read by the Secretary from the Governor, Boards of Trade and Commerce and prominent citizens, and engineers of Colorado, inviting the Society to select Denver as a proper place; other letters were also read recommending Burlington, Vt. Considerable discussion followed, and the merits and defects

of both localities were talked over by the members present. It was finally voted that "Denver or its vicinity" be selected as the place of the next Convention, and the time and details of the meeting were referred to the Board of Direction with power to act. The proposed excursion to England by some of the members this summer, was postponed, owing to an announcement that the time of holding the London-American Exhibition had been changed to May, 1887. The renewed invitation by the officers of the Exhibition for the year named, was tabled for the present, as there is time enough to act upon it at the next Annual Meeting.

The Committee on the formation of a joint library with other engineering societies reported through its chairman, Mr. Wm. P. Shinn, that they had had a conference with committees of the societies of American Mining Engineers, American Mechanical Engineers and the American Society of Electrical Engineers, and that while they could report substantial progress, they were not yet ready to give a detailed report; the Committee was continued.

The Committee on uniform standard time also reported encouraging progress since last meeting; and showed that the American Society of Civil Engineers was practically entitled to much credit for the present prominence of this new time departure. At the annual meeting of last year it was reported that 71 managers of railways in the United States and Canada, and representing many thousands of miles of track, had favorably considered the 24 o'clock system; this number has been added to in the last year, and among these the Canadian Pacific R. R. has adopted it, and has now changed its time tables, station clocks and the watches of all train employes to adapt them to the new standard. The year 1900 is suggested as a fitting time for making the new system universal, as by then all local prejudices would be probably removed and the benefits of the new time properly appreciated. This report was also accepted and the Committee continued.

The Committees on "The 24 Hour System" as applied to Railroads, and "The Compression of Cement Mortars and Masonry Joints" reported progress and were continued. The Committee on Changes in the Organization of the Society not being ready to make a full report, the matter was referred back to them for further and definite action.

The tellers, Messrs. Swann, Cartwright, Flagg and Prindle, having reported that they had finished the canvass of the ballot for officers for 1886, the result of the total of 513 allots cast was announced as follows:

*President*, Henry Flad; *Vice Presidents*, T. F. Rowland, T. C. Kiefer; *Secretary and Librarian*, John Bogart; *Treasurer*, J. James R. Croes; *Directors*, G. S. Greene, Jr., Wm. R. Hutton, W. H. White, H. G. Morris, C. L. Strobel.

After a lunch served in the Society House the session was resumed about 2 P. M. Dr. Egleston of the School of Mines, Columbia College, reported further progress on the 24 o'clock system and exhibited and explained to the members several clocks constructed to meet the requirements of the proposed time change. The President then announced the names of a Committee to investigate the subject of Standard Rail and Wheel Sections.

At the request of members present, Dr. Egleston gave the results of some careful personal investigation and study of the causes for the rapid disintegration of the obelisk erected several years ago in Central Park. He found that it was a true physical disintegration, that the granite was thoroughly cracked and was likely to continue to do so. This monument had been exposed for 3500 years to the burning sun of Egypt with a constant expansion and contraction of surface due to the surrounding conditions; but while the initial cause of the present trouble lay in its long exposure in Egypt, the air was there so very dry that no rapid deterioration followed; its decay was very slow. When it was brought to New York and subjected to changes of temperature ranging over 150°, the conditions at once became serious; the moisture penetrating the already thoroughly fissured stone became at times a mass of ice which in expanding pushed off great flakes of stone from the original surface and exposed new faces upon which the same agents could again act. Dr. Egleston, while admitting that parafine properly applied and under the proper conditions was the best known preservative for a stone surface, remarked that its application to the present obelisk was a monument of officicial folly only equalled in magnitude by the monument it was intended to preserve. The preliminary heating of the surface and the removal of over 700 pounds of loose granite flakes only intensified the action which originally caused the trouble; and as granite is not porous, like a sandstone for example, the parafine was a mere surface application and would have no lasting beneficial effect. He prophesied that unless the obelisk was housed in a building where the temperature was about uniform it would not last more than 35 or 40 years. The obelisk of the Luxor in Paris and that on the Thames embankment in London, were suffering in a similar manner but not to quite the same degree as the one in Central Park. Granite will in its normal condition absorb about one per cent. of moisture, but it is found that certain sides of the granite obelisk in London will absorb over 7 per cent., owing to its disintegrated condition.

Dr. Rothwell then exhibited and explained to the members a model and drawings of a novel device for submarine tunnelling. The tunnel, which is controlled by the Submarine Tunnel and Tube Company, of New York, has already been described in this journal, so that we need say little more than that it is to be made of flanged cast-iron plates, 3 inches in thickness, bolted to a portion of tunnel already built and projected inside of a movable caisson which is pushed forward over a previously dredged path by hydraulic jacks reacting upon the completed tunnel section. The company are now seriously contemplating the tunnelling of the Northumberland Straits to Prince Edward's Island by this method, and are negociating for a tunnel at Detroit and others in the vicinity of New York.

After an announcement by the Secretary of the programme of the Committee of Arrangements for the excursions over the new Croton Aqueduct and 10th Avenue Cable Road, the session of the day closed.

On the evening of Wednesday, Mr. B. S. Church, Chief Engineer of the Aqueduct Commission, gave to a large number of members in the Society's House a short sketch of the history of the New Croton Aqueduct and then explained by charts and plans and a number of special illustrations the engineering features of the present work. The remarks of Mr. Church were listened to with great interest and many questions from members were answered, especially with reference to the many misstatements by outsiders regarding the proposed Quaker Bridge Dam.

On the morning of Thursday, at 9 o'clock an excursion was made by special train to the New Aqueduct. At Croton Station the party were conveyed by carriages to the site of the Quaker Bridge dam, and then to the new gate house at Croton Dam, and after examining the works at that point a handsome lunch was served at the house of the keeper of the dam by Chief Engineer Church. After lunch the party embarked on a special train of the New York City and Northern R. R., and next stopped at Shaft 17, down which most of the members descended and inspected the tunnelling and brick work there in progress. On arriving at the New York terminus of the road a short trip was made over the 10th Avenue Cable Railroad under the charge of Col. Wm. H. Paine, the Chief Engineer of the company.

Though the day was disagreeable, the trip was thoroughly enjoyed by the members and much approbation expressed at the importance of the work and the manner in which it was being carried out.

This very successful Annual Meeting ended with a reception for gentlemen at the Society's House at 9.30 P. M., which was largely attended by members and guests, and, as usual, was voted an exceedingly enjoyable event.

*Names of Members and Guests Attending Annual Meeting*:

Fred Graff, *President*, Phila., Pa.; O. E. Michaelis, Capt. of Ordnance, Watervliet Arsenal, West Troy, N. Y.; J. J. R. Croes, Ch. Eng., Suburban Rapid Transit Co., N. Y. City; Robt. Cartwright, Stamford, Conn.; Geo. H. Bishop, Middletown, Conn.; Wm. G. Hamilton, New York; Wm. R. Hutton, Consulting Eng., New York; Gen. Geo. S. Greene, Morristown, N. J.; Geo. S. Greene, Jr., Eng. in Ch. Dept. of Docks, New York; Theodore Cooper, Consulting Eng., New York; Chas. H. Swan, Boston, Mass.; Horace Loomis, Asst. Eng., Dept. P. W., New York; F. C. Prindle, Civil Eng., U. S. N., Bloomfield, N. J.; Chandler D. Starr, New York; Thomas F. Rowland, New York; Frank O. Whitney, Boston, Mass.; A. B. Hill, City Eng., New Haven, Ct.; Henry Goldmark, New York; E. Sweet, State Eng., Albany, N. Y.; J. M. Knap, Con. Eng., New York; Geo. B. Mallory, Con. Eng., New York; W. R. Curtis, Rockland, Mass.; E. B. Van Winkle, Con. Eng., New York; R. I. Sloan, Ch. Eng., Mann. Elev. R. R., New York; A. M. Wellington, Editor *R. R. Gazette*, New York; John F. O'Connor, England; C. J. Woodbury, Boston, Mass.; W. Howard White, New York; Mendes Cohen, Baltimore, Md.; D. McN. Stauffer, ENGINEERING NEWS, New York; Wm. P. Harris, Asst. Eng., B. & O. Div. Penna. R. R., Pittsburg, Pa.; Ellis B. Noyes, Bayonne, N. J.; Samuel M. Gray, City Eng., Providence, R. I.; Samuel H. Chittenden, Washington, D. C.; Henry C. Meyer, Editor *Sanitary Engineer*, New York; F. Collingwood, Elizabeth, N. J.; E. P. Dawley, Eng., N. Y., P. & B. R. R., Providence, R. I.; D. E. McComb, Asst. Eng., Dist. Govt., Washington, D. C.; Stephen S. Haight, City Surveyor, West Farms, New York; John Y. Culyer, Brooklyn, N. Y.; F. N. Wilson, Princeton, N. J.; Albert L. Webster, West New Brighton, Staten Island, New York; R. E. Briggs, Fairhaven, Massachusetts; L. L. Buck, New York,; E. D. Leavitt, Jr., Con. Eng., Cambridgeport, Mass.; John G. Van Horne, New York; Louis Lesage, Ch. Engineer, Water Works, Montreal, Canada; H. A. Bentley, City Eng., Newport, R. I.; Robert L. Harris, New York; Col. J. W. Adams, Consulting Eng., D. P. W., New York; Edward P. North, New York; William P. Shinn, U. P. N. Y. Steam Co., New York; Charles Hatch, New York; John W. Bacon, R. R. Commiss., Danbury, Conn.; P. P. Dickinson, New York; C. H. Myers, Asst. Eng., D. P. W., New York; F. W. Hodgdon, Asst. Eng., Harbor and Land Commiss., Boston, Mass.; E. B. Webster, Asst. City Eng., Providence, R. I. M. S. Greenough, Gas L. C., Boston, Mass.; J. Gardner Sanderson, Scranton, Pa.; P. Roberts, jr., Phila., Pa.; Wm. H. Wiley, New York; F. A.

Calkins, Asst. Eng., D. P. Parks, New York; A. W. Trotter, New York; C. W. Hunt, New Rochelle; C. M. Harris, New York; Chas. B. Brush, Hoboken; N. J. Welton, Waterbury, Ct.; G. M. Rusling, Hackettstown, N. J.; A. B. Paine, New York; S. B. Opdyke, New Haven, Ct.; J. W. Furguson, New York; Henry R. Towne, Pres. Yale and Towne Mfg. Co., Stamford, Conn.; John D. Fouquet, New York; C. C. Martin, Ch. Eng., N. Y. & Brooklyn Bridge, Brooklyn; Jos. P. Davis, New York; F. H. Howes, New York; W. B. Mackenzie, Asst. Eng., Colonial Rys., Moncton, N. B.; L. F. Olney, Mickleton, N. Y.; Thomas D. Lovett, Cincinnati, Ohio; Clark Fisher, Trenton, N. J.; Fred S. Odell, New York; W. Harrison Smith, N. Y.; W. E. Worthen, N. Y.; A. P. Boller, N. Y.; G. M. McNulty, N. Y.; J. F. Flagg, New York; W. H. Goodwin, Gen. Supt., L. V. R. R., Bethlehem, Pa.; G. Leverich, Brooklyn, N. Y.; C. D. Ward, New York; G. H. Frost, ENGINEERING NEWS, New York; C. C. Schneider, New York; W. J. Haskins, Dept. P. W., New York; W. F. Booth, Poughkeepsie, N. Y.; Col. W. H. Paine, 10th Avenue Cable Road, New York; John R. Freeman, Lawrence, Mass.; J. A. Bensell, New York; C. H. Latrobe, Baltimore, M. D.; Capt. W. W. Maclay, Dept. Docks, New York; E. R. Andrews, New York; Dr. Thos. Egleston, New York; L. B. Ward, New York; L. H. Ransome, London; L. F. Beckwith, New York; John J. Hopper, Asst. Eng., D. P. P., New York; H. D. Blunden, Eng. Maintenance of Way, N. Y., L. E. & W. R. R., New York; C. E. Emery, Man., N. Y. Steam Co., New York; J. F. Flagg, New York; C. C. Brown, New York; J. A. Partridge, Washington Aqueduct, Washington, D. C.; E. C. Appleton, Canajoharie, N. Y.; T. H. McKenzie, Southington, Ct.; W. B. Ewing, Yonkers, N. Y.; Walter McFarland, New York; Geo. A. Just, New York; A. T. Preyer, New York; T. C. McCollum, Navy Yard, New York; S. Wimmer, St. Marys, Pa.; G. McDerby, New York; C. E. Fogg, Poughkeepsie, N. Y.; A. Bryson, New York; A. J. Zabriskie, Newark, N. J.; J. K. Ford, New York; S. W. Hoag, Jr., New York; R. L. O'Brien, New York; S. F. Morris, Yonkers, N. Y.; Chas. G. Drew, New York; B. S. Church, Ch. Eng., Aqueduct Com., New York; E. Sherman Gould, Yonkers, N. Y.; C. H. Latrobe, New York; H. W. B. Phinney, New York; P. R. Yates, Yonkers, New York; S. B. Downes, New York; C. H. Henderson, New York; Geo. B. Francis, New York; Maxwell Smith, New York; W. Watson, Boston; I. A. Shaler, New York; W. B. Parsons, New York; J. P. Tooffe, New York; Jas. C. Bayles, Pres. Am. Inst Mining Engr., S. L. Cooker, Yonkers, New York; Baron de Lorme, Paris; W. G. Elliot, New York; Chas. Colne, Panama Canal; Thos. C. Meyer, W. L. Saunders, New York; E. E. R. Tratman, Brooklyn, N. Y.; Chas. Macdonald, E. L. B. Gardiner, New York; Fred. Brooks, Boston; C. H. Corbett, W. E. Hill, New York; T. S. Stevens, Athens, Pa. A. P. Barnard, New York; J. Owen, Newark, N. Y.; O. F. Nichol, New Nork; D. C. Sanford, New Haven, Ct.; O. W. Barnes, Rowland R. Hazard, F. O. Norton, New York; Samuel Rea, Philadelphia; L. Van Wyck, F. W. Watkins, C. W. Raymond, New York; A. Connor, Yonkers, N. Y.; S. M. Felton New York; C. H. Bunce, Hartford, Ct.; T. W. Bailey, Whitestone, N. Y.; A. Haviland, New York; C. G. Darrah, Philadelphia, Pa.; Jas. Movlan, Jersey City, N. J.; Jos. O. Osgood, Milton, Mass.; Lieut. E. L. Zabriski, Ft. Hamilton, N. Y.; F. H. Clement, New York; W. E. Rogers, Albany, N. Y.; C. L. Rowland, New York; C. S. Maurice, Chas. Kellogg, Athens, Pa.; C. A. Stetefelt, W. M. Barr, Geo. Herbard, Paine, New York.

## PERSONAL.

FRANK E. ELLMAKER, assistant civil engineer of the New York Division of the Pennsylvania Railroad, has been appointed superintendent of the Belvidere Division of that road on Friday next.

JAMES DUNN, chief engineer of the St. Louis & San Francisco Railroad, has been appointed assistant general manager to Capt. C. W. Rogers, vice-president and general manager of that road, who has been very ill for some time past, but who is now much better.

BENNETT SMITH, Nova Scotia's pioneer shipbuilder, died at Halifax, N. S., Jan. 11th, aged 78 years His vessels are known in every shipping port of the world. He leaves an estate of over $1,000,000.

ROBERT M. HASBROUCK, a prominent civil engineer, died at his residence on the 18th, at Schaghticoke, near Troy, aged 63 years. He was born in Albany, and graduated at Lafayette College, in Easton, Penn. He then secured a position as engineer on the Erie Canal. Then for a number of years he was engaged on the Croton Aqueduct, and was one of the constructing engineers of the High Bridge. Afterward he resumed work on the Erie Canal. He was City Engineer of Troy for a long time, and for the past two years he had been Deputy State Engineer. MR. HASBROUCK was a member of Assembly in 1865, and before that he served two years as Chairman of the Rensselaer County Board of Supervisors.

The Harlem Bridge Commission, on Jan. 18, announced the award of the first prize of $1,500, for the best plan for a bridge across the Harlem River, to C. C. Schneider, C. E. The second prize of $1,000 was awarded to the plan presented by Wilhelm Hildenbrand, C. E. The award of the third prize of $500 has not yet been announced.

## Michigan Engineering Society.

The Seventh Annual Convention of the above Association will be held at the State University, in the City of Ann Arbor, on Jan. 26, 27, 28.

The following are among the papers to be presented:

"Water Supply," A. C. Sekell, City Engineer, Grand Rapids; "Underground Surveying," H. B. Sturtevant, M. E., Ishpeming; "Technical Education," Prof. J. B. Davis, Ann Arber; "Ice Machines," F. M. Dunlap, Detroit; "Pile Drivers for Railroad Work," W. L. Clements, Bay City; "Novel Experience in Mechanical Engineering," F. E. Kirby, Detroit; "Results from Experiments," Prof. M. E. Cooley; Ann Arbor; "Foundations on Quick-Sand," R. C. Carpenter, Lansing; "Village Plats," H. D. Bartholomew, Lansing; "Saw Mill Machinery," D. K. Allington, East Saginaw; "Motive Power in Electric Lighting," Jessie Smith, M. E., Detroit; "Answers to Practical Queries in Surveying."

THE members of the Congo Railway Syndicate met on January 5th at the Manchester Chamber of Commerce, Lord Egerton, of Tatton, presided. Mr. J. F. Hutton, M. P., gave a detailed report of the negotiations which had been carried on in Brussels with the Ministers of His Majesty the Sovereign of the Congo State, and submitted a copy of the agreement which had been signed by General Strauch, Minister of the Interior, M. Van Eckveld, Minister of Foreign Affairs, and M. Van Neuss, Minister of Finance, on behalf of the King; and by Messrs. W. Mackinnon, H. M. Stanley, and J. F. Hutton, on behalf of the company. The company is to be founded by Royal Charter, and it is proposed to call it "The Royal Congo State Railway and Navigation Company." The Congo Government will grant the company all the lands for the railway stations, etc., and in addition 10,000 acres of land and all minerals for every mile of railway constructed. Certain privileges and concessions relative to the Custom duties, freedom from taxes, and guarantees of traffic are also to be granted to the company. The memorandum was agreed to. The meeting was adjourned to July 20th, in London.—*The Colonies and India.*

# CORRESPONDENCE.

## Lowest Price of Water.

OFFICE OF CITY ENGINEER.
ROANOKE, VA., Jan. 13th, 1886.

EDITOR ENGINEERING NEWS: I notice in your issue of Jan. 2d, 1886, page 13, a clipping from the St. Paul & Minneapolis *Pioneer Press*, in which the writer gives the annual rent of $37 each for fire hydrants in the city of Waterloo, Iowa, as the lowest price paid by any city in the United States. The city of Roanoke, Va., only pays $30 per year rent, and started in 1883 with 35 hydrants, and can take 20 more at the same figure.

Yours truly,
JOS. SHINHER.

## Grease in the Boston Sewers.

BOSTON, JAN. 15, 1886.

EDITOR ENGINEERING NEWS:—The short article on "Grease in the Boston Sewers," in the last number of ENGINEERING NEWS, was very exact, except in the matter of the thickness of the body of grease in the shaft. You may be interested in the more recent developments.

As the upper layers of grease were removed to the surface of the water, that below began to rise and was easily shoveled out, it was soon found that only the upper twenty feet had risen. The next forty feet which had the consistency of hard butter was dislodged in pieces by apparatus running in the guides that are in the shaft.

The next twenty feet was as hard as castile soap. The dredging apparatus—provided at the bottom with three small chisel-edges and loaded with a third of a ton—when dropped several feet penetrated but a few inches. The hardness of the grease below this for another ten feet is—to quote the report of my foreman,—"terrific." The dredging apparatus refused to go further and a cutter, fifteen inches radius, turned a dozen times through this layer in one place, has failed to make a hole through it. This grease does not appear to float readily and it may be that, owing to compression, its specific gravity is as great as that of water. Below this layer there is nothing but a few feet of uncompressed grease balls.

The hardness of the grease appears to have been occasioned in this way: It first filled the upper part of the shaft, and clinging to guides and beams, formed a barrier to the rise and fall of the water. The lower portion of this barrier of grease and all subsequent accumulations have, therefore, been repeatedly rammed by the fluctuating water pressures below. In addition to this, both air, carried into the tunnel with the sewage, and gas caused by decomposition find vent up the shaft, and, when the grease formed a sufficiently tight dam, they may have accumulated in sufficiently large quantities to have produced a pressure of from twenty to forty pounds per square inch. We had our reasons for not touching the grease before, but after the difficulties encountered in removing it, we shall have more weighty reasons for cleaning our big grease trap oftener.

Very truly yours,
F. P. STEARNS.

## Wellington's Location of Railways.

BOSTON, MASS., Jan. 15, 1886.

EDITOR ENGINEERING NEWS:—In the last number of the NEWS you say that the last quotation for "Wellington on Location" was $20 and none to be had at that. If anybody is as anxious as that for a copy, I can relieve him with one in good condition.

ALBERT H. HOWLAND,
12 West St., Room 20.

[The price mentioned, $20, is correct. The application was made to this office, but the order could not be filled. We had a couple of other calls at $15 offered. We do not know of any engineering publication other than this which commanded such a premium, and it is the very highest testimonial to the merits of Mr. Wellington's book that could possibly be offered. The new book, for it has been entirely revised, and in large part rewritten, will bring the subject of the economic location of railways up to the latest date. The following is from Mr. Wellington direct, of date the 8th inst.

"In answer to inquiries whether another edition of Wellington's "Economic Theory of the Location of Railways" will soon be published, we desire to say that the delay in the publication has been due to the necessity of a revision of the work. The change from iron to steel rails, and from light to heavy engines, has made this work laborious, and the occupations of the author have left him little time for it, but the work is now nearly ready for publication."

We will be pleased to take the names of subscribers to the forthcoming book, and at the very earliest date we will announce price and date of issue.—EDITOR ENGINEERING NEWS.]

## English vs. American Railways.

7 POULTRY, LONDON, E. C., January 8, 1886.

EDITOR ENGINEERING NEWS:—In your issue of December 12, 1885, Mr. George R. Radford, M. Inst. C. E., evidently criticises, through you, my paper recently read before the American Society of Civil Engineers, comparing English and American Railroads.

He is in error in giving $180,000 as the average cost per mile of the English roads. On page 9 of the General Report to the Board of Trade for the year 1884, will be found the following, relating to the railroads of the United Kingdom:

| | 1884 | 1883. |
|---|---|---|
| Mileage ..... ..... | 18,864 | 18,681 |
| Double or More Mileage | 10,239 | 10,105 |
| Capital ..... | £801,464,367 | £784,921,312 |
| Capital per Mile Open | £42,486 | £42,017 |

I do not suppose he will dispute these figures, or their authority.

In my opinion a small part of the above cost was re-subscribed to the capital of other roads, and consequently appears in their cost also. This is not very clear in the statement, but in order to be on the safe side, I deducted it, making the net cost as stated in my paper. No similar reductions have been made from the reported cost of the American railroads, there are undoubtedly many cases where it should be done.

From the above figures, it appears that 46 per cent. of the mileage of the railroads of the United Kingdom is single track. Mr. Radford says (ENGINEERING NEWS, page 370) "The average cost of Irish lines to 1856, mostly double, was $75,000 per mile, and subsequent single lines, $30,000 to $35,000, all complete.

The following table shows the exact cost of these roads:

*Statement showing the length, total cost, and cost per mile, of all the Railroads in Ireland, over fifty miles in length. From the Board of Trade Returns for* 1884.

| Name. | Length of Line in Miles Open on December 31, 1884. | | | Cost. | |
|---|---|---|---|---|---|
| | Double or More. | Single. | Total. | Total. | Per Mile. |
| Belfast and County Down ..... ..... | | 68 | 68 | £ 958,259 | £14,092 |
| Belfast and Northern Counties..... | 33 | 184 | 217 | 1,935,114 | 8,913 |
| Cork and Bandon..... | | 76 | 76 | 620.942 | 8,170 |
| Dublin, Wicklow and Wexford..... | 27 | 108 | 135 | 2,307,486 | 17,090 |
| Great Northern of Ireland..... ..... ..... | 136 | 367 | 503 | 6,732,032 | 13,400 |
| Great Southern and Western of Ireland.. | 195 | 301 | 496 | 7,767,578 | 15,660 |
| Midland, Great Western of Ireland..... | 149 | 276 | 425 | 4,669,808 | 10,988 |
| Waterford & Central Ireland..... | | 60 | 60 | 633,739 | 10,562 |
| Waterford & Limerick | 32 | 238 | 270 | 2,162,736 | 8,010 |
| Total and average of all the railroads in Ireland (22 in number)..... ..... | 574 | 1951 | 2525 | 35,754,001 | 14,160 |

The cost of these roads are greater than stated by Mr. Radford, and less than 23 per cent. of the total mileage are double tracks.

My paper simply related to the railroads of the United States and the United Kingdom, I being familiar with them, and able to obtain reliable official data relating to them, and not to the railroads of Hungary, Argentine Republic, Australia, etc., of which I have no personal knowledge or reliable data.

Mr. J. S. Jeans in his recent great work "England's Supremacy," which is a monumental collection of statistics and facts, on page 284 says:

"The railways of the United Kingdom, however, labor under the manifest disadvantage of being the most expensive of all. Their average cost up to the end of 1883 was over *forty five thousand pounds* per mile, against only about 12½ thousand in the United States 27 thousand in France, 21 thousand in Prussia, 25 thousand in Belgium, and 22 thousand in Austria."

Mr. Radford says (page 370 ENGINEERING NEWS), the Hungarian roads cost from $26,500 to $36,000 per mile complete, and are "practically as good as the best of American roads." Are these roads included in Mr. Jeans' estimate of cost of the Austrian roads, which is from three to four times more than Mr. Radford's ?

In my opinion much money has been unnecessarily spent on the railroads of the United Kingdom in making easy grades and curves suitable for the English rolling stock. If rolling stock similar to the American had been adopted, the radii of curves could have been reduced over one half, without interfering with speed or safety: this alone would have made on many lines a very large saving in the cost of construction.

Yours most truly,

EDWARD BATES DORSEY,
M. Am. Soc. C. E.

## New Orleans and Its Exhibition.

Special Correspondence ENGINEERING NEWS.

NEW ORLEANS, LA., Jan. 11, 1886.

Just now the great attraction at New Orleans is supposed-to-be the North, Central, and South American Exposition. The writer can not but regret that the enthusiasm of the friends of the Exposition has allowed them to create expectations in the minds of visitors, that can not be fully realized. While there is a great deal to be seen, and much that is interesting, the representations have been such that the visitor is always disappointed. There are no foreign exhibits, and only small ones from Honduras, Nicaragua, and the United States of Colombia. In the manufacturing industries there is less than last year, and nothing that would interest the readers of the NEWS.

Many of the states make exhibits which are better than those of last year, and highly creditable in themselves. Several of the Southern states, notably Arkansas, Alabama and Tennesee, make exhibits of the great variety of their mineral resources, and Mississippi and Louisiana show samples of their wealth of native timber. While this display of samples of the natural resources of a state has popular interest, and possibly scientific value, it fails in a commercial aspect, which was supposed to be the chief object of this Exposition, in not also presenting data concerning the location, extent, accessibility to transportation, etc., of the product attempted to be extolled. There are a number of methods by which such information can be presented in a very striking and yet pleasing way. The object of such exhibitions should be something higher than simply to pile up a great heterogeneous mass of material. This classification, arrangement, and display of an exhibit costs a large amount of time and money, but to go part way and not accomplish this, is nearly a waste of the little that is expended. The Exposition as a whole was lacking very much in this respect, although a few of the state exhibits were admirable.

From a study of the Exposition and from conversation with representative men from various localities, the writer concludes that there are certainly many opportunities in the South for the investment of capital, with a good prospect for fair returns. The residents are fully aroused to their needs, and desire money and enterprise from the North to aid them in developing their natural resources, in agricultural lands, timber, mines, manufactures, etc.

The people of New Orleans are hoping to make that place a great commercial centre for the South and the Mississippi valley, and also develop a great export trade. They seem to think that all that is needed to accomplish this is for the general Government to make large appropriations for the improvement of the Mississippi river. There is an unfortunate spirit of helplessness and dependency about the matter, and a disposition to overestimate the advantages to be derived from any proposed improvements. A little of the enterprise which has built up Chicago or Kansas City would be worth far more than all the river improvements the Government can or will make. It is probable that the day of steamboating has passed, the railroads having largely taken the place of river navigation. Although New Orleans has but lately had adequate railroad connections with the rest of the country, the roads have already diverted a considerable portion of the cotton trade from New Orleans.

One of the things that must retard the prosperity of New Orleans and even the whole state of Louisiana is the lottery business. Everyone has seen the advertisements and heard of the Louisiana State Lottery, but he must go to New Orleans to realize its magnitude and demoralizing effect. Every cigar stand in the city sells lottery tickets, and seemingly everybody, intelligent and ignorant, rich and poor, old and young, buys. There is a daily, and also a grand monthly, drawing. The writer was told by an officer of the lottery, that $3,000 to $4,000 worth of tickets were sold each day for the daily drawing, and a reliable resident said that for a day or two before the monthly drawing there was a perfect jam about the local ticket offices. To their credit, be it said, that the more intelligent citizens are working earnestly to rid themselves and the state of this great incubus; but like some other corporations at the North it has the state in its power and so far has been able to successfully resist all such attempts.

Public improvements are provided for by reserving ten per cent. of the lottery revenues; this fund is very carefully guarded by state laws to prevent misappropriation of any kind. If wisely expended, New Orleans would before many years have some very much needed improvements; unfortunately, as in many another city, the engineering department is regarded as of no material importance, and consequently the money is not always wisely expended. The municipality is very much in need of a thorough and comprehensive system of engineering. For example, there is no bench or street monument in the whole city; and, notwithstanding the gravity of the drainage question, the water in the gutters is often impeded by insufficient openings under the streets and sidewalks. The culverts seem to be of one size throughout, regardless of whether they are at the rise or at the month, two or three miles below.

The drainage problem in New Orleans is peculiar. As in all alluvial countries, the land slopes away from the river, the drainage being into Lake Ponchartrain. For the purpose of controlling the drainage, the statutory limits of the city include 187 square miles, although the actual city covers only about 40 square miles. There are no sewers, the only drainage being through the gutters into canals from which it is lifted 7 ft. by water wheels into other canals, which empty into the lake. The fall is so slight, that an old shoe dropped into the gutter may back the water up for two blocks. The condition of the gutters can readily be imagined. During a rain almost the entire city is under water; at times, Canal, the principal business street, has 5 or 6 inches of water over the sidewalks. It is claimed that New Orleans is a healthy city, but how it can be so under these conditions is difficult to imagine. The preliminary steps are being taken to secure an entirely new system of drainage. It is proposed to lay sewers, put in improved machinery capable of lifting the water a much greater height, and construct new canals. There have been no new facilities for drainage in 25 years, and possibly not in forty years.

Only a few of its streets are paved, and these with granite blocks 1 foot by 1½ feet by 8 inches, laid flat. The soil is so very soft and wet that the blocks are easily displaced: this and their great size make it an exceedingly poor pavement. Even this kind of pavement costs $5.75 per square yard, the stone having been brought from Maine. The unpaved streets are simply unpassable in muddy weather. The Barber Asphalt Paving Company are laying their pavement on some of the prominent streets; it meets the requirements admirably and is very popular with property holders.

For drinking water, some of the citizens use rain water stored in wooden tanks; others use the river water as furnished by the water company, some filtering it and others not. The water company, which is a private one, is making arrangements for clarifying the water by the use of perchloride of iron, at a cost of forty to fifty thousand dollars per year. A few artesian wells have been sunk, from which a small quantity of excellent water is obtained. The depths vary from 400 to 450 feet, and the flow from 8 to 10 gallons per hour. A deeper well is now being sunk as an experiment in search of a larger flow; it is intended to go at least 1200 feet, 1,000 of which is completed. Artesian wells at other places along the Gulf coast give an abundant supply of good water.

The street car system of New Orleans is very complete and the city is well lighted with electricity. In these two features of city government, New Orleans is well up with the other large cities of the Union.

I. O. B.

## New York State News.

SCHENECTADY, N. Y., Jan. 20, 1886.

Special Correspondence ENGINEERING NEWS.

Our ancient city seems to be waking up. During the past few weeks the new sewers, designed by Prof. Cady Staley, of Union College, have been completed and are now working successfully.

A new depot, built at a cost of $40,000 by Mr. John McEnroe for the N. Y. C. & H. R. R. R., has just been accepted.

The new depot has been built across the abandoned portion of Liberty street, and foot traffic in that street will be maintained by means of a bridge over the tracks and depot sheds. The bridge is in two spans, with iron piers and abutments, having three covered stair ways leading to it. The bridge and an iron shed have been built by Van Zile, McCormac & Co., of Albany. The Schenectady Gas Co. have nearly completed their electric light plant for lighting the streets. 81 Remington lights will be used at a cost to the city of 42 cents per lamp per night.

At the last Meeting of the Common Council a petition was presented for permission to erect poles for the wires of a new company who propose to furnish incandescent lights for stores and dwellings, also 2 petitions from persons who wish to build and operate lines of Street Railroads in the city.

During the past few month the neighboring town of Glenville has repaired the Mohawk River Bridge at a cost of $8,000 and built 8 stone culverts and 3 iron bridges to replace those destroyed by the same cloud burst that washed away a large culvert under the N. Y. C. R. R. last summer.

The iron work was done by the Groton Bridge Company of Groton, N. Y.

The Morse Bridge Company of Youngstown, Ohio, have lately completed a bridge over the Mohawk at Rexfords Flats 4 miles below this city.

The bridge consists of seven spans of 95 feet each and replaces a wooden structure.

There is some prospect that a bridge will be built across the Mohawk at Vicksburg Ferry next summer.

## Nebraska News.

OMAHA, NEB., Jan. 19, 1886.

Special Correspondence ENGINEERING NEWS.

Bids for paving will be opened on the 26th by the Board of Public Works, Omaha. Bids are asked for sheet asphaltum, asphalt blocks, Sioux Falls granite, Colorado sandstone and other stone, macadam and wooden blocks. There will be about $200,000 worth of paving done this year.

A company has been formed at Rapid City, Dakota, to build and operate a street railway.

The Gypsum Mining company and the City Milling company have been organized at Rapid City, Dakota, representing a capital stock of $210,000.

The Yankton city council has destroyed $11,000 in Northwestern railroad bonds—bonds issued but not needed in closing the deal with that company.

The contract for the new bridge across the Platte river has been let to Raymond and Campbell, of Council Bluffs, Ia. It will be of iron and 2,000 feet long.

The Missouri Pacific R. R. are building from Papillion to a junction with the Omaha Belt R. R., a couple of miles west of Omaha. The O. B. R. R. are making connections with the other roads and completing their road as fast as the weather will permit.

The B. & M. R. R. have let a contract to build 100 miles north and west of Grand Island, which line will run between the two branch lines of the U. P. R. R., running in that direction.

The N. P. R. R. have let a contract to build forty miles extending one of their branches in the same general direction but in new territory.

The opening of bids on the Tenth and Eleventh street, Omaha, proposed viaducts, took place in the room of the Board of Public Works, on the 14th. Representatives of a number of leading bridge companies of the United States were present. It is estimated that the total cost of getting up plans for these viaducts has been at least $10,000. The following are the bids put in by the various companies:

| | |
|---|---|
| Columbia Bridge Company: | |
| On Eleventh street, with 20 feet roadway | $ 94,422 00 |
| King Iron Bridge Company: | |
| Tenth street, 20 ft. roadway | 97,747.66 |
| Tenth street, 30 ft. roadway | 110,599.39 |
| Eleventh street, 20 ft. roadway | 81,018.96 |
| Eleventh street, 30 ft. roadway | 107,497.60 |
| N. S. Carttor & Co,: | |
| Eleventh street, 20 ft. roadway | 68,900.00 |
| Eleventh street, 30 ft. roadway | 79,800.00 |
| Morse Bridge Company: | |
| Tenth street, 20 feet roadway | 93,300.00 |
| Tenth street, 30 ft. roadway | 94,300.00 |
| Albert H. Wolf: | |
| Tenth street, 20 ft. roadway | 84,800.00 |
| Eleventh street, 20 ft. roadway | 73,700.00 |
| Keepers & Riddell: | |
| Eleventh street, 20 ft. roadway | 70,790.00 |
| Eleventh street, 30 ft. roadway | 85,966.00 |
| Raymond & Campbell: | |
| Eleventh street, 20 ft. roadway | 72,450.00 |
| Eleventh street, 30 ft. roadway | 87,195.00 |
| W. G. Coolidge: | |
| Eleventh street, 20 ft. roadway, iron piers | 69,000.00 |
| Eleventh street, 30 ft. roadway, iron piers | 87,500.00 |
| Mo. Valley Bridge and Iron Works: | |
| Tenth street, 20 ft. roadway | 68,210.00 |
| Tenth street, 30 ft. roadway | 82,385.00 |
| Eleventh street, 20 ft. roadway | 62,256.00 |
| Eleventh street, 30 ft. roadway | 73,780.00 |
| Wrought-Iron Bridge Company: | |
| Eleventh street, 20 ft. roadway | 81,600.00 |
| A. Gottlieb: | |
| Tenth street, 20 ft roadway | 78,800.00 |
| Tenth street, 30 ft. roadway | 96,800.00 |
| Eleventh street, 20 ft. roadway | 91,151.00 |
| Eleventh streeth, 30 ft. roadway | 94,274.00 |
| Detroit Bridge and Iron Works: | |
| Tenth street, 20 ft. roadway | 96,848.00 |
| Tenth street, 30 ft. roadway | 121,800.80 |
| Eleventh street, 20 ft. roadway | 79,672.00 |
| Eleventh street, 30 ft. roadway | 96,575.00 |
| Pennsylvania Bridge Works: | |
| Tenth street, 20 ft. roadway | 94,980.00 |
| Eleventh street, 30 ft. roadway | 99,092.00 |
| Keystone Bridge Company: | |
| Eleventh street, 20 ft. roadway | 93,394.00 |
| Eleventh street, 30 ft. roadway | 115,362.00 |
| Drake & Stratton: | |
| Tenth street, 20 ft. roadway | 106,382.00 |
| Tenth street, 30 ft. roadway | 140,985.00 |
| Eleventh street, 20 ft. roadway | 104,032.00 |
| Eleventh street, 30 ft. roadway | 136,235.00 |
| Curtis & Driver: | |
| Tenth street, 20 ft. roadway | 85,351.00 |
| Kansas City Bridge and Iron Works: | |
| Eleventh street, 20 ft. roadway | 72,382.00 |
| Eleventh street, 30 ft. roadway | 100,500.00 |
| Chicago Forge and Bolt Company: | |
| Tenth street, 20 ft. roadway | 81,317.00 |
| Tenth street, 30 ft. roadway | 108,837.00 |
| Eleventh street, 20 ft. roadway | 63,634.00 |
| Eleventh street, 30 ft. roadway | 86,326.00 |

The lowest of the above bids for the Eleventh street viaduct, with a 20-foot roadway, is $62,256 by the Missouri Valley Bridge company, while the highest is $104,032 by Drake & Stratton. The lowest on a 30-foot Eleventh street viaduct is also by the Missouri Valley Bridge Company at $73,780, while the highest is by Drake & Stratton, $136,235. On the Tenth street structure the bids are so varied and mixed that no definite conclusion has been reached as yet as to which firm has really made the lowest bid.

## Ohio News.

URBANA, O., Jan. 19th.

Special Correspondence Engineering News.

W. B. Jones has been succeeded as County Surveyor of Van Wert county, by Marion P. McCoy.

Robert D. Wynn, the oldest stone contractor in southern Ohio, died on the 19th ult. He had done a great amount of work for the Chesapeake & Ohio, Dayton & Southern, I. B. & W., and Scioto Valley R. R., and employed about fifty men the year round. He left an estate valued at $40,000.

The name of the Ohio Central Railroad has been changed to Kanawha and Ohio, with headquarters at Charleston, W. Va.

Fred Howell was elected County Surveyor of Muskingum county, O., at the last election and assumed the office Jan. 4, 1886.

A Zanesville, Mt. Vernon & Monon Railroad was incorporated Jan. 4, 1886.

Natural gas has been found at Mt. Blanchard, O., at 1,200 feet.

The County Commissioners of Defiance county, O., have decided to build a new iron bridge over the Maumee river at Defiance.

The County Commissioners of Defiance county, O., will receive proposals up till noon, February 16th, for constructing two stone abutments and one center pier, and a bridge of two spans, each 187 feet in length, 24 feet roadway, 26 feet high; capacity, 100 pounds per square foot.

The County Commissioners of Hardin county, O., have decided to build a new jail.

The incorporators of the Zanesville, Mt. Vernon and Marion Railway, have elected A. E. Boone, President, and John B. Yates, Chief Engineer, both of Zanesville. It is believed that a low grade can be established. The engineer is engaged in securing an entrance to the city.

The contract for furnishing the Zanesville and Ohio River Railway Company 70,000 ties and 1,250,000 feet of lumber, has been awarded to J. F. Burgess, of Zanesville. The price is not known.

## Illinois and Indiana News.

Special Correspondence ENGINEERING NEWS.

CHAMPAIGN, Ill., Jan., 1886.

Decatur, Ills., will, the coming season, pave two routes from the business portion of town to the depot, in all about two miles. The details of the work have not been decided upon. Brick will probably be used.

The Masons of Danville, Ills., contemplate erecting a $30,000 four story temple at that place this year.

Considerable interest is being taken in Northern Indiana in the proposed improvement of Kankakee river from Momence to La Porte, along which lies an immense body of land which might be drained and made richly productive. Congress is to be asked for an appropriation.

During the past week the following corporations have been granted licenses by the Illinois authorities. The Pullman Reduction Company, at Chicago, to carry on a general mining business; capital stock $500,000; incorporators, Charles W. Griggs, Charles C. Boveney, and Edward T. Noovan. The Cairo Water Company, at Cairo, to construct, maintain and operate water works within or near the city of Cairo; capital stock $125,000; incorporators, Wm. H. Green, Wm. B. Gilbert, and Miles Frederic Gilbert. The Chicago, Calumet & Eastern Railway Company; principal office at Chicago; to construct a railway from Chicago to the town of Thorntown, on the line of the state of Illinois and Indiana, and thence eastward; capital stock $500,000; incorporators, B. K. De Young, John Farnon, S. Montgomery Smith, E. R. Gillette and Henry Hudson.

It is rumored, with some show of reason, that the Chicago and Alton road will build a direct line from St. Louis to Kansas City the coming season. For several years this road has been making important and expensive changes in the grades and alinement of its line through Missouri, which are now about finished.

The Wabash has been spending considerable money the past season on its Chicago line for snow fences, etc.; during the late blizzard it brought out a snow train manned by forty men and provided with a kitchen and quasi dining room, besides an abundance of provisions.

Galesburg, Ills., is having a good deal of trouble with her water works. For nearly two years there has been a controversy between the contractor and the council, concerning the acceptance of the works, the latter alleging insufficiency of supply. During a fire recently it took twenty minutes to get up fire pressure, owing to leakage, which was subsequently found to be 150 gallons per minute.

The St. Louis and Cairo Railroad (narrow gauge) has passed into the hands of the M. & O., which will change the gauge and use it as a St. Louis branch. This will be another reason why the roads crossing the Ohio river at Cairo should build a bridge there. Bore holes have been sunk 500 or 600 feet without finding any thing except sand, from which it appears that probably a channel pier is out of the question. The banks are very low, and the river is about 3,000 feet wide. The question of the best type form of bridge for this location is a very interesting one. The bridge will unquestionably come in time.

Some of the local papers announce that the Illinois Central railroad is debating the feasibility of building a double track from Cairo to Chicago. Your correspondent has authority for saying that no such move is intended for the immediate future. During the coming summer the company will probably lay about 25 miles of additional track from Monee to 4 miles south of Kankakee. This will give them 60 miles of double track, from Chicago south. For a number of years, in making ordinary improvements, as laying additional sidetracks, borrowing earth from the right-of-way, etc., the possibility of a double track from Chicago to Cairo has been kept in mind, and improvements made accordingly.

A curious statement occurs in an account of a little fire in the new state house at Indianapolis, now in process of erection. The workmen built a fire in a grate the flue of which "had not been completed, and the *timber in it*, which had not been covered with the lead sheeting, ignited." The question naturally occurs, Why is the wood in the flue at all? And this in what the Hoosiers claim is one of the finest buildings in the country.

The City Water Co., of East St. Louis, Ills., has completed its organization for the purpose of erecting and maintaining water works in that city. The capital stock of the company is $250,000, all paid in. An election of officers was held on the 12th inst., resulting as follows: Charles Thaw, president; C. S. Masten, vice-president; Frank H. Pond, secretary and treasurer; directors, S. C. Clubb, Chas. Thaw, Thos. Howard, Morris R. Locke, Frank H. Pond, C. S. Masten, W. C. Masten.

The works are to be in operation by June 1st, 1886. As soon as the weather permits, a large force of men will be put on and the work prosecuted with vigor.

In the item which appeared in this column last week concerning the cost of draining 90 acres of land, there were so many typographical errors and omissions, that we repeat the item this week.

| | | | | |
|---|---|---|---|---|
| 5,647 | 3-inch | tile at | $10.00 per M | $56.47 |
| 3,437 | 3½-inch | " " | $13.00 " " | $44.68 |
| 4,211 | 4-inch | " " | $15.00 " " | $63.16 |
| 2,110 | 5-inch | " " | $22.00 " " | $46.42 |
| 788 | 6-inch | " " | $30.00 " " | $23.64 |
| 1,137 | 7-inch | " " | $40.00 " " | $45.48 |
| 368 | 8-inch | " " | $50.00 " " | $18.40 |
| | | Total for tile | | $298.25 |
| Paid for 1,034 rods at 35 cents per rod for tiling | | | | $361.90 |
| Paid extra for depth over 3 feet | | | | 17.40 |
| Hauling tile one mile from works | | | | 15.00 |
| Filling ditches after tiling | | | | 8.50 |
| | | Grand Total | | $701.05 |

B. J. Gifford, Rantoul, Ills., has received a sub-contract for about $10,000 of ditching in Vermillion swamp, Ford county, Ills., which he expects to excavate with his hydraulic plow. The principal contractor, Mr. Latham, of Pontiac, has been using a chain-and-bucket dredge, which has not been very satisfactory; excluding the above he has about $20,000 to $25,000 worth of work yet to do.

## WATER

STOCKTON, CAL., is looking forward to being supplied with water from the Stanislaus river.

CALAIS, ME., are discussing water works. W. E. McAllister, druggist, is the man to address.

### Water Pressure in Mains of Various Cities.

COMPILED BY J. J. R. CROES. FROM SPECIAL RETURNS, DEC. 1885.

| Town and State. | Topography. | Difference of level in town. | In Business District. | | Fire Pressure. |
|---|---|---|---|---|---|
| | | | Day Pressure. | Night Pressure. | |
| | | feet. | lbs. | lbs. | lbs. |
| Anamosa, Ia. | level. | —— | 300 | 300 | 400 |
| Bellefonte, Pa. | hilly. | —— | 40 to 80 | 40 to 80 | 80 to 100 |
| Brenham, Tex. | undulating. | —— | 42 | 42 | 85 |
| Bridgeton, N. J. | hilly. | —— | 37 | 37 | 37 |
| Bristol, Pa. | level. | 0 | 40 | 40 to 60 | 125 |
| Brookline, Mass. | hilly. | —— | 90 to 100 | 90 to 100 | —— |
| Brookville, Pa. | hilly. | —— | 85 to 90 | —— | —— |
| Buffalo, N. Y. | | 50 | 30 | 30 | —— |
| Burlington, Ia. | hilly. | 161 | 90 | 90 | 120 to 150 |
| Burlington, Vt. | hilly. | 50 to 200 | 75 | 75 to 85 | 150 to 170 |
| Cadillac, Mich. | hilly. | 200 | 57 | 40 | 120 |
| Carleton, N. B. | hilly. | 60 to 90 | 30 | 40 | 60 to 70 |
| Carrollton, Mo. | hilly. | 95 | 80 | 65 | 130 |
| Carthage, Mo. | mostly level. | 15 to 20 | 40 | 35 | 80 to 150 |
| Catasauqua, Pa. | hilly. | 80 | —— | —— | —— |
| Cedar Rapids, Ia. | hilly. | 72 | 60 | 45 | 100 |
| Central Falls, R. I. | hilly. | 60 to 70 | 90 | 110 | 90 to 110 |
| Chamberlain, Dak. | hilly. | 100 | 100 | 100 | 100 |
| Chambersburg, Pa. | level. | 15 | 35 | 40 | 70 |
| Charleston, Ill. | level. | —— | 25 | 25 | 80 to 100 |
| Charleston, Mass. | hilly. | 75 | 52 | 55 | 52 to 55 |
| Charleton, S. C. | level. | 0 | 40 | 35 to 40 | 35 to 40 |
| Chateaugay, N. Y. | level. | 0 | 50 | 55 | 55 |
| Chattanooga, Tenn. | hilly. | 60 | 55 | 56 to 57 | 55 to 57 |
| Cheboygan, Mich. | level. | 15 | 40 | 40 | 80 to 120 |

PETERSBURG, ILL., is prepared to receive propositions for furnishing that city with water for fire and domestic purposes.

B. R. ROUSE, of Indianapolis, has finished a complete water works system for the state insane asylum near that city. At a recent test they were pronounced a success.

GEO. F. WOOLSTON, who is building the Albuquerque, N. M., water works, is negotiating with the City Council for the construction of the Socorro, N. M., water works. The Albuquerque works were to be completed on the 15th inst.

GEO. E. SPECHT, C. E., of San Francisco, Cal., has been making surveys and examinations for water works and drainage at Fort Thomas (U. S. Military Station) on the Upper Gilamon, Arizona. Mr. Specht will probably be Consulting Engineer for the San Diego, Cal., sewerage.

ALBANY, Jan. 18.—The Common Council to-night, by a vote of 15 to 2, passed over the Mayor's veto a resolution adopting the driven well system of water supply in place of the river supply, now in use. The question was decided in a secret meeting previous to the open session of the Council.

AT a meeting of the Water Works Committee of the Manchester City Council, contracts for pipes in connection with the Thirlmere water works scheme were granted to Messrs. Macfarlane and Company, Glasgow, to the extent of £110,000, and to the Staveley Iron Company to the amount of £120,000. The contracts will, it is expected, be confirmed at next Council meeting.—*Coal & Iron Trades Review.*

THE Mason Regulator Company of Boston have recently put upon the market a new pressure regulator for steam pumps. It can be seen working in the Boston office of Henry R. Worthington. One of them has recently been applied to a tank pump destined for the Equitable building, St. Louis.

UNLESS the Board of Public Works hits upon some scheme to give this city a better and cheaper supply of water, the water works will soon cease to realize their working expenses. For a year past some of the largest consumers of water have complained at the quality of water supplied and the price they were charged.—Grand Rapids (Mich.) *Times.*

ROBERT T. MULLEN, of New York, who is engaged in water works contract failing some two years ago by a vote of the people to get a contract for the construction of water works in Newark, O., entered suit in the Court of Common Pleas against the city and the present contractors, Hinds, Moffat & Co., for $100,000 damages.—Pittsburg *Commercial Gazette.*

FOR some time there has been talk of bringing natural gas to Buffalo for heating and illuminating purposes. Definite steps have at last been taken. A company has been formed, headed by Daniel O'Day of the Standard Oil Company, with a capital stock of $250,000. The Common Council has been petitioned for permission to lay and maintain pipes in the streets.

THE St. Paul Chamber of Commerce has referred to a committee the matter of setting on foot a movement to bore in that vicinity for natural gas. There is said to be no reason why it should not exist under the St. Paul formation in as large quantities as at Pittsburg, and if natural gas were discovered here it would be as valuable to this city as the St. Anthony Falls waterpower is to Minneapolis. It is believed worth while to spend some money to test the matter.

THE Sixth Ward, St. Paul, will be connected with the city water mains by pipes laid across the river. The water board does not expect to lay the water mains across the river until next winter, but all the preliminary work will be done this year. The stage of water is now twelve and a half inches below government zero, and when the mains are sunk on the sand bottom they will be placed five or six feet lower than this level. The mains to be used for crossing the river will be sixteen-inch ones, of iron and with flexible joints.

AT a meeting of the New Lots, L. I., Health Board held recently, Ex-Supervisor Jewell, Chairman of the Committee, appointed at a meeting of citizens, a few weeks ago, to confer with the Board of Health on the question of sewerage, reported that they had seen Martin G. Johnson, a surveyor, and that that gentleman had informed them that two main sewers would be sufficient for the town, and that he would be able to give an approximate cost in about two weeks.

The Town Clerk was instructed to confer with General Steinmetz and get his estimate of the cost.

THE report of the City Engineer of Atlanta, Ga., referring to the water works, gives the totals for the year as follows:

Water pumped, 876,055,300 gallons; coal burned, 4,286,000 pounds (2,145 tons); average number of gallons pumped to 100 pounds of coal consumed, 204,039; average number of gallons pumped per day, 2,400,154; average number pounds of coal burned per day, 11,742; average pressure, 130 pounds (300 feet head); cost of pumping a million gallons, $28.70; cost of pumping a thousand gallons, $2.87; total expenditures for the year, $32,576.70; operating expenses, $25,145.63; expended on construction, $7,431.17; income for water rents, $39,283.33.

THE Norway Water Supply Company, Norway, Me. have closed a contract with Henry R. Worthington, of Boston, and it is expected the new works will all be complete by next fall. The water is to be forced into a reservoir on Pike's Hill.

A COMPLETE system of iron and lead pipes, with fixtures, is being erected on the outside of the Museum of Hygiene at Washington, from the ground to the roof with an observing station at each of the three stories, for an exhaustive series of experiments covering all the topics in dispute, pertaining to trap siphonage and the utility of the mechanism of water-closets, traps, water basins, baths, sinks, etc., as well as to the numerous ones on which there are no reliable data, together with microscopical and chemical tests of the action of sewer air and different waters an pipes and tanks. These experiments will be conducted by Mr. Glenn Brown, architect, who will give the results to the public through the Bureau of Medicine and Surgery.

A COMMITTEE consisting of the Controller, Recorder and City Chamberlain, appointed to examine the proposed plans for increasing the water supply in the dry goods district, have presented a report to the Sinking Fund Committee. It sets forth that the plan of the New York City Water Company is the most complete and feasible. The opinions of Fire Commissioner Purroy, Engineers B. S. Church, G. W. Birdsall and Julius W. Adams were also submitted. Mr. Purroy said that the plan of the company will meet the demand for the needed supply. The mains now are not large enough, and the pressure not sufficient. He thought that one large main should be carried down town to furnish water to the high buildings. The engineers report that in their opinion the supply of water will be sufficient for all purposes. The company proposes to sink wells and pump water from a stratum of saturated gravel, which they say, underlies the whole of Manhattan Island.

The company in its proposal says that it will expend at least $1,500,000 in putting in the necessary plant. In return it asks the city to pay annually 10 per cent. on the outlay for ten years at least. If the service fails the city is to be relieved from the payment of rental. The committee say that this company's plan is the best presented to it. Chamberlain Ivins moved that the Corporation Counsel be requested to draw up the proper contract with the company and include the main asked for by President Purroy, but at no increased expense to the city. This was agreed to.

THE WILLIAMSPORT, PENN., WATER WORKS.—*To the Editor of the Gazette:*—In replying to your inquiry as to the operations of the water company during the past year, it may be stated that 10,869 feet of new supply main has been laid, besides repairs and changes briefly mentioned, as follows: During the long season of intense cold, before the snow fell last winter, the frost penetrated the ground to a depth of more than five and a half feet in some of the streets, closing 869 feet of main pipe; of this total 582 feet was opened without loss, while the remaining 316 feet was split and ruined, and had to be relaid. A number of persons witnessed the removal of the Walnut street line crossing Third street, on April 17th, 1885, when it was found to be solidly filled with ice, clear as crystal, though under four feet of covering. On the second day of June last, while opening a trench through the shaving piles at the Keystone mill, a large quantity of ice was encountered.

Owing to the change of grade in several streets, and other causes, nine parts of lines were lowered so as to secure them from the effects of frost in the future, and although much less than during the previous year, it yet amounted to 742 feet; this work is almost invariably accomplished without shutting the water off, though the drop may be two or more feet and the line several hundred feet in length.

In order to equalize the pressure it was found necessary to reinforce the supply in some localities where the consumption has increased beyond the original expectation, and for this purpose three lines of four inch main were removed and lines of six or eight inch pipe substituted, amounting to 1,625 feet. Thirty-two feet of abandoned four-inch iron pipe was removed; 378 feet of six-inch wood-log pipe being split, from settling in made ground, was taken out and iron put in its place, after correcting the alignment and grade. This wood pipe had been in the ground about eighteen years, and was taken out in sound condition; had it not been disturbed it would doubtless have lasted as long as uncoated iron.

The city is now supplied with water through two sixteen-inch cast-iron mains, one of which is reinforced by an eight-inch main, and the other by the new six-inch line from Cramer's run, which results in placing the static head of 140 feet on the north bank of the river without loss from friction; the united capacity of these two mains is through an end area of 402 square inches. The work is in progress for increasing the supply to the city during the coming summer, by lay-

ing another line, partly twenty and the remainder of sixteen-inch from Mosquito valley, where a storage reservoir will be erected as the increased consumption may require. It might be more economical to construct a large pumping station at the river, but it is believed that mountain spring water is more palatable, more wholesome and more uniformly clear and cool than river water, and is preferred by the majority of our citizens. During the year just closed, the pump was in operation for thirteen days, and this to a great extent on account of repairs and extensions taking place at either one or the other of the reservoirs during the month of October, and at no other time during the year was the pump in use.

The mains of distribution and supply now exceed an aggregate of fourty miles, on which are placed 275 main gates and 19 other gates, used for flushing purposes; these latter are systematically opened, to free the pipes of any sediment or stale water that may accumulate, as well as relieving unavoidable dead ends. There are also 236 fire hydrants, for 168 of which the city pays ten dollars each per annum—the lowest known rate in the United States or elsewhere so far as can be ascertained; the remainder of the fire hydrants are owned and maintained by private interests.

The improvements about the reservoir, outlined a year ago, have not been entirely accomplished on account of more important work, but, being under way, will doubtless be completed during the coming season, so that the surroundings will be more attractive than heretofore.

It has been the policy of this company to extend their lines of mains wherever the applicants would guarantee six per cent. on the first cost, trusting to future patronage for maintenance and other expenses. It has frequently happened that the development of the city took a different course from that at first indicated, and the result is that to-day there are several miles of pipe that has passed its prime and now adds to the repairs account, while it has never paid a cent on the original investment, and is as little needed to-day as when first put in the ground.

J. H. McMINN,
Superintendent Water Works.

## NEWS OF THE WEEK.

### Railroads, Bridges and Canals.

**The Delaware Hudson R. R.** is now building an extension to Wilkesbarre.

**The Kings County Elevated R. R.** has commenced erecting its superstructure on Fulton street, Brooklyn.

**Brockville & Westport R. R.**—The first sod of the Brockville and Westport Railway was turned Jan. 12., at Newboro, Ont., by the wife of Dr. Preston, president of the company.

**The Welland Canal.**—The plans and specifications for the enlargement of the Welland canal, so as to admit vessels drawing 14 feet of water, have been prepared and are now on exhibition at the office of Mr. John Page, chief engineer of canals, Department of Railways and Canals at Ottawa.

**The Pennsylvania R. R.** will begin the erection of an iron bridge across White river at Columbus, Ind., on the J., M. and I. division, to take the place of the old wooden structure, which is not considered very safe, as soon as spring opens,

**New Trunk Line.**—HALIFAX, Jan. 20.—A largely attended meeting of the electors of Inverness County, Cape Breton, was held at Port Hood to-day. Resolutions were passed advocating the building of a trunk line railway through Cape Breton Island by the Dominion Government and branch lines by the local Government.

**The Kansas, Missouri and Chicago Bridge Company** has been incorporated to construct a railway and highway bridge across the Missouri river, near the old town site of Quinlan, three miles above Kansas City. The Directors are W. J. Buchan, V. J. Lane, A. D. Barrows, D. E. Cornell, T. A. Scott, F. A. Maher, D. W. Ward, of Wyandotte; W. H. Miller and W. K. Faulkner, of Kansas City. Capital stock, $750,000.

**Franchise Granted.**—The Board of Trustees of the village of Mount Vernon at their meeting on Tuesday evening granted a franchise to the Mount Vernon, New Rochelle and Yonkers Surface Railroad Company to put down rails in the streets. They also granted a franchise to a water company, which proposes to furnish the village with pure water from Hutchinson Creek.

**Government Stops a Railroad.**—It is said that there have been found some serious obsta les in the way of the proposed extension of the Minneapolis & Minnehaha Motor line. It was originally intended to extend the line from Minnehaha to Fort Snelling, and then cross the river, come down on West Seventh street a short distance, then branch off and enter St. Paul on what is called the Stewart avenue route. This would necessitate crossing the United States military reservation. It is said that this crossing will not be permitted, and that Gen. Terry has even ordered the surveyors off from Uncle Sam's premises.

**The Niagara Falls & Whirlpool Railway Company** has been incorporated. The gauge is to be between thirty and forty-two inches. The route is from the foot of the inclined railway at the Americam Falls, along the easterly margin of the river to a point about 400 feet below the foot of the whirlpool. The distance is about three miles. The capital stock of the company is $100,000, in shares of $100 each. Mr. Ensign Bennett, of Buffalo, has been chosen President and E. A. Fisher, of Rochester, Chief Engineer. Surveys and estimates will be made at once. It is not decided whether steam, water or electricity will be used for motive power.

**New Croton Aqueduct Bids.**—The following are the totals of the bids for constructing Sections 12, 13 and 14 of the New Croton Aqueduct opened on the 20th at the office of the Commissioners:

| Contractors. | Section 12. | Section 13. | Section 14. |
|---|---|---|---|
| Rogers & Co | $376,310.00 | $458,050.00 | $680,430.00 |
| Beckwith & Quackenbush | 401,000.00 | 457,375.00 | 665,840.00 |
| O'Brien & Clark | 430,345.00 | 476,475.00 | 705,112.00 |
| Arnold & Stevens | 442,666.25 | 501,527.50 | 745,197.50 |
| Jno. Cox & Co | 443,185.25 | 501,081.25 | 712,901.25 |
| Collins & Farwell | 446,702.50 | 465,641.25 | 687,625.00 |
| Douglass, Dalzell & Douglass | 449,629.75 | 478,020.00 | 731,356.50 |
| Page, Smith & Carey | 459,361.25 | 440,937.50 | 650,652.50 |
| P. P. Dickinson | 470,107.25 | | |
| Broadhurst & Lentz | 493,222.50 | 494,925.00 | |
| M. S. Coleman | 520,650.00 | 524,200.00 | 777,915.00 |
| Brown, Howard & Co | 521,185.00 | 543,750.00 | 802,612.50 |
| Smith, Ripley & Casement | 530,711.50 | 483,662.50 | 703,617.50 |
| Malone & Mathews | 552,625.00 | 528,304.75 | 632,45 ',50 |
| Jno. Brunton & Co | | 418,565.00 | 619,115.00 |

**The Chicago & Northwestern R. R.** will be extended to La Salle, Ill., next summer. The Chicago, Milwaukee & St. Paul R. R. also proposes to extend to that city.

**Contract.**—BANGOR, ME., Jan. 20.—At a meeting of the stockholders of the International Railroad of Maine this morning it was voted to authorize the Directors to contract with the International Railroad of Canada for the immediate construction of the road.

**Hudson Bay Railway.**—WINNIPEG, Manitoba, Jan. 19.—Major Jarvis, who represents the contractors, and Mr. Money, who represents Mr. Shefford, of England, Chief Engineer of the Hudson's Bay in Railway, have returned from a survey of a route to Hudson's Bay, and report the project for a railway to the bay perfectly feasible at a cost of $7,000,000. A report is being prepared to cable to England.

**Financial Succor.**—GALVESTON, TEXAS, Jan 19th.—A special to the *News* from Matamoras says: "It is stated that a prominent business house here has received notice from their London correspondent that the Mexican National Construction Company has borrowed money from Matthiesson & Co., of London, to continue the construction of that road, and that work will be resumed inside of three months."

**Air Line of the C. P. R. R.**—Two surveying parties have been sent out to survey the air line for the C. P. R. between Montreal and Smith's Falls—one in charge of Mr. Thomas White, C. E., and the other under Mr. Stewart, C. E. The intention is to commence work early in the spring, and it is said this will give a route from Toronto to Montreal fifty miles shorter than the Grand Trunk.

**The Croton Valley Railway Company's** articles of incorporation have been filed in the Whestchester County Clerk's office. It is proposed to start from the Hudson river at the mouth of the Croton river, in Cortlandtown, and thence run along the north bank of the Croton to a station on the line of the New York City and Northern Railroad, known as Croton Lake North, being a distance of eight miles. The capital stock of the company is $100,000, and the Directors are George C. Lee, John C. Coleman, Theodore S. Strange, John L. Logan, William G. Davis, Daniel Jackson, George J. Boyd, Thomas C. Broadhurst, Charles C. Edey, Gilbert M. Spier, J. A. Bigelow Kellogg, Randolph B. Martine, and Charles A. Jackson.

**Testing a New Bridge.**—The lower Wynantskill bridge, at Troy, New York, was successfully tested recently. The test included a deadload of 15,030 pounds on the east walk, 15,480 on the west walk, 53,510 pounds on the roadway and a moving load at a sharp trot of 18-550 pounds, making a total of 101,570 pounds. The required test was 100,000 pounds. The pressure estimated for the bridge in square feet is 153,000 pounds, which multiplied by four, the safety factor, gives an ultimate resistance of 612,000 pounds. With the dead load there was no deflection and with the moving load added there was a deflection of one-sixteenth of an inch. The length of the bridge is forty-five feet, the width of the roadway twenty feet and of the walks five feet each. The greatest load ever carried by the old bridge was 30,000 pounds. The new bridge was constructed by Van Zile, McCormack & Co., of Troy and Albany.

**New Jail.**—A jail to cost $12,640 is to be built at Newtown, Fla.

**A New Court House** is to built at Los Angeles, Cal. Cost $250,000 to $300,000.

**The Cincinnati, Van Wert & Michigan R. R.** has contracted for the grading of its line from West Manchester, its southern terminus, to the Miami river. The contract for the rails has been given to the Cambria Iron and Steel Works.

**The Kentucky and Indiana Bridge Company** has contracted with T. H. Hamilton, of Toledo, for the construction of the bridging and trestling from Rudd avenue and Thirty-second street southward to the city limits. The contract embraces four spans of bridge over Rudd, High and Portland avenues and Bank street and a half mile of trestle work.

**Railroad Depot.**—The contract for building the new passenger depot of the Atlantic Coast Line, to be erected at Richmond, Va., has been awarded to Cubberly & Kafer, of Trenton, N. J. The work will be commenced in the early spring.

**The Minnesota & Northwestern R. R.**, has let the contract to D. C. Shepherd & Co. to do the grading of the company's Chicago cut-off, from Hayfield to Dubuque. The cut-off is 170 miles in length, 120 of which is an extension of the Minnesota & Northwestern R. R. The other fifty miles will constitute the Dubuque & Northwestern R. R. Of the latter, eight miles have been graded and are now ready for track-laying. This brings the graded portion of the road up to a point known as Farley. The contract awarded is for the grading between Farley and Hayfield. The conditions of the contract are that tracklaying must be commenced May 1, and the entire line ready for operation by Nov. 1.

**Brooklyn Bridge Contracts.**—A contract has been closed with W. & T. Lamb, Jr., to do the brick and mason work of the four arches to be completed in New York, for $36,799. The other bidders were C. Hanfield & Co., $47,837; J. P. Rowland, $46,731; Robinson & Wallace, $42,949; John Cox & Co., $42,643,58; P. J. Carlin, $68,750; Darrow & Co., $45,662; Edward Morrissey, $43,779; John Kelleher, $43,338. The arches are to be finished during the coming summer. A contract has also been closed with Charles O. Brown, of Patterson, N. J., for 51,000 pounds of steel girders and 175,000 pounds iron beams, to be used in the construction of the enlarged terminus over High street, for $4.19 and $3.65 per pound respectively, a total of $8,524.40. The only other bid was that of Cooper, Hewitt & Co., of the New Jersey Steel and Iron Works, Trenton, N. J., for $9,040. The Phenix Bridge Company, which had been invited to bid, declined after examining the specifications, finding thereby that the work was too far out of their line to be profitably undertaken. The contractor will be required to get into place during the next sixty days. Mr. Martin is preparing plans for the completion of seven more of the vacant archways, five between Cliff and Vanderwater streets and two between Cherry street and the anchorage. Twelve low arches remain between Rose and North William streets and these will be built up during the summer. The cost of completing the present lot is estimated at $120,000.


### CONTRACTING.

*There is no single class journal in the United States read by so many contractors for all kinds of Civil Engineering construction as* ENGINEERING NEWS AND AMERICAN CONTRACT JOURNAL. *We propose as in the past to publish early intelligence of all new contract work. Our prices for advertising proposals for contracts is twenty cents per line, and it is so cheap that parties having any work to advertise will always find it a good investment to use this journal.*


**Paving Prices.**—St. Paul, Minn., paid the following prices during the past year; Granite blocks on concrete foundation, $2,50; cedar blocks on plank foundation, $1.30; and "Kerr pavement," $3.40 per square yard.

# Market Report of Engineering Materials.

**New York, January 21, 1886.**

NOTE.—The following Market Report gives wholesale prices on the New York Market unless otherwise stated. It is intended as a general guide to the estimating engineer. We give it with this caution, that, as is well understood in business transactions, the amount of bill, distance from market centre and conditions of payment will have a material influence on the final paying prices.

## IRON.

| | | | |
|---|---|---|---|
| STRUCTURAL IRON. | | | |
| Angles | | 1.95 @ | 2.00 |
| Tee | | 2.25 @ | 2.35 |
| Beams and channels American | | 3.0c. @ | |
| Tank | | 2. @ | 2.1c |
| Shell | | 2.4c. @ | 2.5c |
| Steel plates, Tank | | 2¼c. @ | |
| WROUGHT-IRON PIPE, PITTSBURGH. | | | |
| Butt welded, black | Discount | 42½ @ | 45 |
| " " galvanized | " | 32½ @ | 35 |
| Lap welded black | " | 60 @ | 62½ |
| " Galvanized | " | 42½ @ | 45 |
| Boiler tubes | | 55 | |
| RAILS. | | | |
| Steel (large lots at mill) | | $34.00 @ | 35.00 |
| Old rails | | 22. | |
| Old rails steel | | 22.00 @ | 23.00 |
| R R. spikes | | 2.25c. | |
| R R. splice-plates | | 1.70 @ | 1.75 |
| R R. Track Bolts Square Nuts | | 2.75 | |
| Barb-wire fencing, galvanized | | | 5.00 |
| " " painted | | 4.00 @ | 4.25 |
| Corrugated iron | | | |
| Nails | | | |
| Iron, per keg | | 2.65 @ | 2.75 |
| Steel do. | | 2.50 | |

## METALS.

| | | | |
|---|---|---|---|
| COPPER. | | | |
| Lake Superior | | $11.40 @ | 11.55 |
| Other Brands | | 10.30 @ | 10.45 |
| LEAD. | | | |
| Com. Domestic | | 4.65 | 4.67½ |
| Lead Pipe | | .06½c. | |
| Tin-Lined Lead Pipe | | .15 | |
| Sheet Lead | | .07¼ | |
| ZINC. | | | |
| Sheet | | $5.15 @ | 5.45 |

## BRICK.

| | | | |
|---|---|---|---|
| Cargoes afloat) | | | |
| Haverstraw | per M. | $8.00 | |
| Fishkill | | | |
| Up-River | | | |
| Jerseys | | | |
| Long Island | | | |
| " pale | | 4.00 | |
| FRONTS. | | | |
| Croton, red | | 11.00 @ | 14.00 |
| " dark | | 11.00 @ | 14.00 |
| " brown | | 10.00 @ | 13.00 |
| Philadelphia pressed | | 24.00 @ | 25.00 |
| Trenton " | | 24.00 @ | 25.00 |
| Baltimore " | | 37.00 @ | 41.00 |
| Buff " | | 33.00 @ | 35.00 |
| Enameled English | | 65.00 @ | 130.00 |
| " American | | 85.00 @ | 120.00 |
| Fire brick | | 24.50 @ | 55.00 |

## CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

| | | |
|---|---|---|
| Alsen's Portland Cement Works | $2.50 @ | $3.00 |
| BAETJER & MEYERSTEIN: | | |
| Hanover Portland | 2.60 @ | 2.65 |
| BELLONI & Co.: | | |
| Hemmoor "Crown" brand | | 2.50 |
| JAMES BRAND: | | |
| K. B. & S | 2.55 @ | 3.00 |
| BROOKS, SHOOBRIDGE & Co., | 2.45 @ | 2.60 |
| HOWARD FLEMING: | | |
| Gibbs' English Portland, 400 lbs | 2.65 @ | 2.90 |
| K. B. & S. " | 2.75 @ | 2.95 |
| Stettiner, German | 2.65 @ | 2.85 |
| Lagerdorfer, " | 2.45 @ | 2.75 |
| Fieve, A 1, Belgian | 2.35 @ | 2.50 |
| Roman | 2.75 @ | 3.00 |
| Keene's Coarse | 4.75 @ | 5.50 |
| " Fine | 7.75 @ | 8.50 |
| " Superfine | 8.50 @ | 10.00 |
| FISHER, ERSKINE W.: | | |
| Stettin (German) Portland Cement | $2.40 @ | 2.75 |
| GABRIEL & SCHALL: | | |
| Vorwohler "Lion" | 2.65 @ | 3.10 |
| HUDSON RIVER CEMENT Co. Rosendale | | 1. 0 |
| JOHNSON & WILSON: | | |
| Saylor's American Portland | 2.15 @ | 2.40 |
| LAWRENCE CEMENT Co.: | | |
| Hoffman Rosendale | | |
| LESLEY & TRINKLE, Philadelphia, Pa.: | | |
| "Giant" Portland | 2.20 @ | 2.40 |
| Improved "Union" | 1.25 @ | 1.50 |
| Union | 1.10 @ | 1.20 |
| MARCIAL & Co.: | | |
| J. B. White & Bros. Coarse | 4.50 @ | 5.00 |
| " Fine | 8.00 @ | 10.00 |
| " Portland | 2.45 @ | 2.85 |
| NEW YORK CEMENT Co.: | | |
| Rosendale | | 1.20 |
| N. Y. & ROSENDALE CEMENT Co.: | | |
| Rosendale, "Bridge" brand | | 1.10 |
| SINCLAIR & BABSON: | | |
| K. B. & S | 2.35 @ | 2.60 |
| STANDARD CEMENT Co. | | |
| E. THIELE: | | |
| Dyckerhoff | 2.90 @ | 3.25 |
| UNITED STATES CEMENT Co.: | | |
| Windsor | 1.00 @ | 1.10 |
| Standard | | 1.15 |
| Cable's Portland | 2.15 @ | 2.40 |
| UNION AKRON CEMENT Co.: | | |
| Akron "Star" brand | | |

## ASPHALT.

| | | | |
|---|---|---|---|
| Prices range per ton | | $15.00 @ | 20.00 |
| According to quantity or brand, and whether taken from vessel or store. | | | |

## LIME.

| | | | |
|---|---|---|---|
| Rockland, common per bbl | | 1.00 | |
| " " finishing | | 1.20 | |
| State, common | | .90 | |
| " " finishing | | 1.10 | |
| Kingston, ground | | 95 @ | 1.00 |
| Add 25c. to above figures for yard rates. | | | |

## STONE.

| | | | |
|---|---|---|---|
| *Cargo rates at New York.* | | | |
| Amherst freestone, No. 1 | per cub. ft. | 0.95 @ | 1.00 |
| " " No. 2 | " | 0.75 @ | 0.85 |
| " " light drab | " | 0.80 @ | 0.95 |
| Berlin " in rough | " | 0.75 @ | 1.00 |
| Berea " " | " | | |
| Brown stone, Portland, Ct. | " | 1.00 @ | 1.35 |
| " Belleville, N. J. | " | 1.00 @ | 1.35 |
| Granite, rough | " | 0.45 @ | 1.25 |
| Common building stone per load | | 2.00 @ | 3.00 |
| Base stone, from 2¼ to 6 ft. lengths, per lin. ft. | | 0.40 @ | 3.00 |

## SLATE.

| | | | |
|---|---|---|---|
| Purple roofing | per square | 6.00 @ | 7.00 |
| Green | " | 6.00 @ | 7.00 |
| Red | " | 15.00 | |
| Black Penna. (at New York) | " | 4.50 @ | 5.00 |

## LUMBER.

Prices for yard delivery in New York.

| | | | |
|---|---|---|---|
| PINE, Common box | per M. | 18.00 @ | 20.00 |
| " Choice | " | 65.00 @ | 70.00 |
| Tally plank, 1¼ in. 10 in. dres'd, each | | .44 @ | .50 |
| Tally boards, dressed com. | " | .28 @ | .30 |
| SPRUCE, Boards dressed | " | .25 @ | .28 |
| Plank, 1¼ in | " | .28 @ | .30 |
| " 2 in. | " | .38 @ | .40 |
| " 2 in. dressed | " | .43 @ | .45 |
| Timber | per M. | 20.00 @ | 22.00 |
| HEMLOCK, Boards | each. | .18 @ | .20 |
| Joist, 2¼ × 4 to 4 × 6 in | | .16 @ | .44 |
| OAK | per M. | 55.00 @ | 65.00 |
| CYPRESS 1, 1¼, 2 and 2¼ in | " | 35.00 @ | 40.00 |
| YELLOW PINE, Girders | " | 25.00 @ | 30.00 |
| Dressed flooring | " | 28.00 @ | 35.00 |
| SHINGLES, Extra shaved pine, 16in. | " | | |
| " sawed 18 in. | " | 5.75 @ | 6.00 |
| LATH, Cargo rate | " | 2.25 @ | 2.30 |

## PAINT.

| | | | |
|---|---|---|---|
| Lead, white, American dry | per lb | .04½ @ | .06 |
| " " in oil pure | " | .06½ | |
| English, B. B. in oil | | .08½ @ | .08¾ |
| Red, American | " | .05½ @ | .05½ |
| Litharge | " | .05 @ | 05½ |
| Venetian red, American | " | .01 @ | .01¼ |
| Indian red | " | .05 @ | .10 |
| Vermillion, American lead | " | .10½ @ | .12½ |
| Paris green | " | .15 @ | .20 |
| Umber, Amer. raw and powdered | per lb. | .01¼ @ | .01¾ |
| Drop black, Amer. | | .07 @ | .13 |
| " Eng. | | .11 @ | .13 |
| Chrome green | | .05 @ | 20 |
| Oxide zinc, American | | .03¼ @ | .04 |
| " French | | .06 @ | .08 |

## Trade Notes.

To mention a drawing instrument as an "Alteneder" has always been suggestive of the very very best that could be had anywhere. The advertisement of the conservative old firm which still maintains supremacy in its line, will tell where its genuine manufactures are to be found.

A LARGE force of men has been put on at the Rogers Locomotive Works, Paterson, N. J., and the establishment is working full time. Thirty-six engines are laid out for the coming three months.

PITTSBURG, Jan. 13.—The Edgar Thomson steel works closed down at midnight for an indefinite period, because the furnace men refused to accept their terms. The large force of workmen will be paid off at once. The strikers have a sealed to Andrew Carnegie, in New York, and are hopeful of a favorable answer.

AT a recent meeting of the Brickmakers' Union of Western Pennsylvania the price for salmon brick was fixed at $6 50 per 1,000 The oath to abide by the prices was renewed to last for one year. The prices to outside dealers will remain at 50 cents per 1,000 over that asked of contractors and bricklayers.

CONTRARY to the rumor that the structural iron establishments expect big work shortly, the manufacturers of this class of iron and the brokers who deal in it say that business is quiet, and they know of no unusually large orders. The Phœnix Iron Company will be very busy for some time fulfilling its contract to furnish iron for the erection of the elevated railway in Brooklyn.

THE solid, the substantial, the exact, in the gradual development of trade and manufacture, is the chief material of the trade journal. Its importance cannot be over-estimated; its decay would be the obliteration of the history of industrial progress—one of the most important histories of the movements of mankind. The trade journal is one of the best outgrowths of the civilization of the nineteenth century, and has found its development almost wholly within the last two decades. Already it exercises great power upon trade and industry, and the power is widening and deepening. These are trade journals, worthy of the name, recorders, thinkers, teachers, strong in brain, close in expression, exact in logic, convincing in argument and we are happy that it is our privilege to have them as constant companions. They have proved to us a mine of information, of which we have often availed ourselves and for which we thank them.—Sewing Machine News.

THE following tables show the conditions of the blast furnaces of the United States on January 1, 1885, 1886.

1885.

| Fuel. | In blast. No. | In blast. Weekly capacity. | Out of blast. No. | Out of blast. Weekly capacity. |
|---|---|---|---|---|
| Charcoal | 68 | 8 371 | 189 | 15,941 |
| Anthracite | 86 | 21,564 | 135 | 24,500 |
| Bituminous | 82 | 36,812 | 141 | 55,812 |
| Total | 236 | 66,747 | 435 | 100,253 |

1886.

| | | | | |
|---|---|---|---|---|
| Charcoal | 57 | 7,894 | 169 | 16,678 |
| Anthracite | 104 | 29,811 | 117 | 25,518 |
| Bituminous | 114 | 54,199 | 106 | 40,508 |
| Total | 275 | 91,814 | 392 | 82,704 |

THE N. Y. Tribune of the 4th has a very interesting article on "Prices in 1885; the lowest average yet recorded." Quotations of about two hundred articles in daily consumption are compared with the following results:—

COST OF CONSTANT QUANTITIES OF PRODUCTS AT DIFFERENT DATES.

| | Cost in currency. | Price of gold. | Cost in gold. |
|---|---|---|---|
| *Prior to the War.* | | | |
| 1860, May 1 | $100.00 | $100.00 | $100.00 |
| *After the War.* | | | |
| 1865, Nov. 1 | 174.77 | 145.87 | 119.81 |
| 1866, May 1 | 157.60 | 125.12 | 126.04 |
| 1866, Nov. 1 | 170.31 | 148.25 | 117.82 |
| 1871, Nov. 1 | 122.03 | 112 00 | 108.95 |
| *The Panic Period.* | | | |
| 1872, May 1 | 137.13 | 112 50 | 121 81 |
| 1873, Nov. 1 | 115.14 | 108.80 | 106.01 |
| 1874, May 1 | 122.77 | 112.87 | 108.77 |
| *Preparation for Resumption.* | | | |
| 1875, Jan. 1 | 113.01 | 112 37 | 100.57 |
| 1876, Oct. 1 | 97.90 | 110.00 | 88.45 |
| 1877, May 1 | 99.29 | 106.75 | 93.01 |
| 1878, May 1 | 82 09 | 100.37 | 81.81 |
| 1878, Oct. 18 | 77 94 | 100.37 | 77.65 |
| *Resumption.* | | | |
| 1879, Nov. 1 | 93.48 | ..... | ..... |
| 1880, Jan. 1 | 103.42 | ..... | ..... |
| 1881, Jan. 1 | 95.98 | ..... | ..... |
| 1882, May 16 | 106.59 | ..... | ..... |
| *The Recent Decline.* | | | |
| 1883, Mar. 13 | 97.32 | ..... | ..... |
| 1883, Nov. 1 | 88.71 | ..... | ..... |
| 1884, Jan 1 | 88.37 | ..... | ..... |
| 1884, Nov. 21 | 78.47 | ..... | ..... |
| 1885, Jan. 1 | 79.66 | ..... | ..... |
| 1885, May 9 | 80.22 | ..... | ..... |
| 1885, Aug. 22 | 74.86 | ..... | ..... |
| 1885, Nov. 1 | 75.35 | ..... | ..... |
| 1885, close | 78.53 | ..... | ..... |

The writer, Mr. W. M. Grosvenor, remarks further:—

"While prices were lower in 1885 than ever before, controversies between labor and capital regarding the rate of wages have been unusually frequent. A determination of the purchasing power of money at different periods casts much light on these controversies. If it is true, as in many localities workmen claim it is, that retail prices are so high that they cannot live on wages which were ample years ago, then it is evident that either the charges of retail dealers have unduly increased, or the wants of workmen have expanded faster than the means of supplying wants by the creation of wealth. If the trouble is with retail dealers, the customers have only themselves to thank, so long as they do not supply a remedy. When they learn that it is folly to support three times as many retail dealers as are necessary, and that they can secure lower prices by concentrating their custom upon those who sell most cheaply and honestly, they will find that wages will appear a great deal higher than they now are. But in many cases retail dealers are not in fault. It is the truth that severe competition in later years, and the extremely low prices received for products, have caused wages of some laborers to be unduly depressed. It should help both the honest workman in striving to get what is right, and the honest employer in striving to do what is right, to have clearly defined the purchasing power of the dollar in commodities generally at different periods.

Nothing has been said of the influence of partial demonetization of silver upon prices. There are some of course, who will assume that the entire change in the purchasing power of other money has been due to this influence. These will ignore

1. The powerful tendency toward lower prices which follows a collapse of paper inflation as night follows day.

2. The potency of all the agencies employed to insure success in resumption of specie payments.

3. The great changes in prices which are demonstrably due to reduction in cost of transportation.

4. The improvements in processes and in machinery, which reduced the cost of steel rails from $103.50 to $27, and the cost of cotton sheeting from 13 cents to 7 cents, and the cost of paper from 12½ cents to 4¼ cents, and the cost of refined petroleum from 23½ cents to 7 cents, with other changes by the score of like nature."

THE New York Locomotive Works, Rome, N. Y., are building three heavy 10-wheel freight engines for the Rome, Watertown and Ogdensburg R. R.